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INCLUDING

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CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY'.)

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"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomia in conservatione, proportiono, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper astinenda; à verè eruditis et sapientibus semper exculta; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—BRUCKNER, *Théorie du Système animal*, Leyden, 1767.

. The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain-thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.



CONTENTS OF VOL. XIV.

[NINTH SERIES.]

NUMBER 79.

	Page
I. Notes from the Gatty Marine Laboratory, St. Andrews.— No. XLVI. By Prof. M'INTOSH, M.D., LL.D., D.Sc., F.R.S., &c...	1
II. A Triassic Fauna from the Jordan Valley. By LESLIE R. COX, B.A., F.G.S., Department of Geology, British Museum. (Plates I. & II.)	52
III. A Revision of the Old World Cynitacanthacrinini (Orthoptera, <i>Acrididae</i>).—V. Genera <i>Cynitacanthacris</i> to <i>Laiteria</i> . By B. P. UVAROV, F.E.S., Assistant Entomologist, Imperial Bureau of Ento- mology	96
IV. New Species of <i>Cucumaria</i> from Monterey Bay, California. By HARRINGTON WELLS. (Plate III.)	113
V. Some Decapod Crustaceans (<i>Callinassa</i> and <i>Ranina</i>) from the Oligocene of Washington State, U.S.A. By THOMAS H. WHITERS, F.G.S. (Plate IV.)	121
VI. Note on a new Cephalopod, <i>Cirroteuthis</i> (<i>Cirroteuthopsis</i>) <i>massye</i> , Grimpe. By ANNE L. MASSY	127
VII. Descriptions of new African Rhopalocera. By G. T. BETHUNE-BAKER, F.L.S., F.Z.S.	130
VIII. Two Abnormal Chelae of <i>Carcinus maenas</i> , Pennant. By MICHAEL PERKINS, B.A., F.E.S. (Counts Trotter Student and Scholar of Trinity College, Cambridge, and Trotman Exhibitioner of the Worshipful Company of Haberdashers)	136
IX. Oololiths of Fishes from the Upper Kimmeridgian of Bucking- hamshire and Wiltshire. By G. ALLAN FROST, F.L.S., F.G.S., F.Z.S. (Plate V.)	139
X. The Geographical Races of <i>Oryzomys ratticeps</i> . By OLDFIELD THOMAS	143
XI. Notes on the Genus <i>Agrius</i> [Lep'doptera]. By PERCY I. LATHEY, F.E.S.	144

	Page
XII. Von Schlechtendal's Work on Fossil Thysanoptera in the Light of Recent Knowledge. By RICHARD S. BAGNALL	150
XIII. Results of the Merton College Expedition to Spitsbergen, 1923.—Diptera Nematocera. By F. W. EDWARDS	162
XIV. A Note on the "New Zealand Glow-worm" (Diptera, <i>Mycetophilidæ</i>). By F. W. EDWARDS	175
XV. Descriptions and Records of Bees.—CI. By T. D. A. COCKERELL, University of Colorado	179
XVI. Two new interesting Lemmings from Siberia. By B. S. VINOGRADOV, Assistant Curator, Zoological Museum of the Russian Academy of Sciences, Petrograd	180
Proceedings of the Geological Society	180, 191

NUMBER 80.

XVII. On the Post-larval Stage in <i>Diopatra cuprea</i> , Bosc, a Polychaetous Annelid of the Family <i>Eunicidæ</i> . By C. C. A. MONRO ..	193
XVIII. Reply to Miss Procter's Remarks on the Snake <i>Brachyophidium rhodogaster</i> , Wall. By Colonel F. WALL, C.M.G., C.M.Z.S., F.L.S.	200
XIX. Diptera (Cyclorhapha) from Spitsbergen. Results of the Merton College Expedition to Spitsbergen, 1923.—No. 5. By J. E. COLLIN, F.E.S.	201
XX. On the Diptera (other than Nematocera) of Jan Mayen Island. By J. E. COLLIN, F.E.S.	204
XXI. The Genus <i>Chondrilla</i> . By MAURICE BURTON, M.Sc., Research Student of King's College, University of London	206
XXII. Preliminary Revision of the Family <i>Phygadeuonidæ</i> , its Classification and Evolution. By A. V. MARTYNOV (Petrograd) ..	209
XXIII. Decapod Crustaceans from the Oligocene of Anguilla. By THOMAS H. WITHERS, F.G.S. (Plate VI.)	225
XXIV. On a new Species of Fresh-water Amphipod, <i>Carinogammarus annandalei</i> , sp. n., from Algeria. By TH. MONOD (Muséum d'histoire naturelle de Paris)	233
XXV. Papers on Oriental <i>Carabidæ</i> .—XIII. By H. E. ANDREWS	241
XXVI. On a new Empheriid from Uganda (Copeognatha). By H. H. KARNY, Buitenzorg, Dutch East Indies	245
XXVII. New Species of Phytophaga (Coleopt.). By G. F. BRYANT, Entomological Assistant, Imperial Bureau of Entomology.	247

	Page
XXVIII. On the Existence of the Japanese Killifish, <i>Fundul-ichthys virescens</i> . By G. S. MYERS	253

XXIX. A new Species of the Drosophilid Genus <i>Gilona</i> (Diptera), bred from Figs in Cyprus. By Prof. M. BEZZI, Turin, Italy	254
---	-----

NUMBER 81.

XXX. Exotic <i>Muscaridae</i> (Diptera).—XIII. By J. R. MAT-LOCH, Bureau of Biological Survey, Washington, D.C.	257
--	-----

XXXI. Descriptions and Records of Bees.—CII. By T. D. A. COCKERELL, University of Colorado	274
--	-----

XXXII. The Iridescent Species of <i>Euselasia</i> [Lepidoptera]. By PERCY L. LATHY, F.R.S.	283
---	-----

XXXIII. New <i>Callicebus</i> , <i>Conepatus</i> , and <i>Geomys</i> from Peru. By OLDFIELD THOMAS	290
--	-----

XXXIV. New or little-known <i>Tipulidae</i> (Diptera).—XXIV. Aus-tralasian Species. By CHARLES P. ALEXANDER, Ph.D., F.R.S., Massachusetts Agricultural College, Amherst, Massachusetts, U.S.A.	280
---	-----

XXXV. Some new or noteworthy Madagascar and African Hete-rocera. By Lord ROTHSCHILD, F.R.S.	306
--	-----

XXXVI. Notes on <i>Lophoceros jacksoni</i> , Grant, and <i>L. deckeni</i> (Cab.). By Lord ROTHSCHILD, F.R.S., Ph.D.	317
--	-----

XXXVII. The Phylogeny of the Cirripedia. By THOMAS H. WITHERS, F.G.S.	318
--	-----

XXXVIII. On a new Tapeworm from the Duck. By F. J. MEEGITT, M.Sc., Ph.D. (Professor of Biology, University of Ran-goon), and MAUNG PO SAW (University of Rangoon)	321
---	-----

XXXIX. An Abnormal Specimen of the Edible Crab (<i>Cancer pagurus</i>). By W. T. CALMAN, D.Sc., F.R.S.	326
---	-----

XL. The Application of the Law of Priority. By HUGH WATSON, M.A.	328
---	-----

XLI. <i>Solenodonsaurus</i> , Broili, a Seymouriamorph Reptile. By HELGA S. FRANKSON, M.Sc., University College, London.	338
---	-----

<i>New Book</i> :—Bacteriology: a Study of Microorganisms and their Relation to Human Welfare, discussing the History of Bacto-riology, the Nature of Microorganisms and their Significance in connection with Pathology, Hygiene, Agriculture, and the Industries. By H. W. CONN and HAROLD J. CONN	343
--	-----

NUMBER 82.

	Page
XLII. Coleoptera: <i>Ptinidae</i> and <i>Anobiidae</i> of the Seychelles. By HUGH SCOTT, M.A., Sc.D., F.E.S., Curator in Entomology, University Museum of Zoology, Cambridge	315
XLIII. The Hemiptera-Heteroptera of Rodriguez, together with the Description of a new Species of <i>Cicada</i> from that Island. By W. E. CHINA, B.A.	427
XLIV. On a Pelagic Phase of <i>Arenicola marina</i> and of <i>Eteone arctica</i> . By A. MEER and B. STORROW, Dove Marine Laboratory, Cullercoats. (Plate VII.)	453
XLV. A new Subspecies of <i>Nyctinomus australis</i> . By OLDFIELD THOMAS	455
XLVI. New or little-known <i>Tipulidae</i> (Diptera).—XXV. Palearctic Species. By CHARLES P. ALEXANDER, Ph.D., F.E.S., Massachusetts Agricultural College, Amherst, Massachusetts, U.S.A.	457
XLVII. Notes sur les Cercopides de l'Amérique Centrale et Méridionale de la Collection de M. C. B. Williams et de la mienne. Par le Dr. V. LALLMAND (Uccle, Belgique)	477
XLVIII. A Contribution to our Knowledge of the Corrodentia-Fauna of South Sapphalien. By HANJIRŌ OKAMOTO and SATORU KUWAYAMA, Sapporo, Hokkaido, Japan. (Plate VIII.)	486
XLIX. Descriptions of some new Leeches from India, Burma, and Ceylon. By W. A. HARDING, M.A., F.L.S. (Plates IX.-XV.) ..	489
L. On a new <i>Asterias</i> from Chile. By EMILIE GOLDSCHMIDT ..	499
LI. Descriptions of Two new Species of the Genus <i>Nygmia</i> (<i>Liparidae</i>) from East Africa. By W. H. T. TAMS	502
LII. On a new Ammonite (<i>Engonoceras iris</i> , sp. n.) from the Gault of Folkestone. By L. F. SPATH, D.Sc., F.G.S.	504
LIII. On a new Species of <i>Crocidura</i> from Scilly. By MARTIN A. C. HINTON	509
Proceedings of the Geological Society	511

NUMBER 83.

LIV. Exotic <i>Muscaridae</i> (Diptera).—XIV. By J. R. MALLOCH, Bureau of Biological Survey, Washington, D.C.	513
LV. On some new Species of Red Spider. By STANLEY HIRST. (Plates XVI. & XVII.)	522
LVI. A new Pouched Mouse (<i>Phascogale</i>) from Northern New South Wales. By OLDFIELD THOMAS	528
LVII. A new Genus of <i>Bythoscopiae</i> (<i>Jussidae</i> , Homoptera) from West Australia. By W. E. CHINA	529
LVIII. Un <i>Scammus</i> (<i>Pallus</i>) nouveau de Mexique (Col., <i>Coccinel-</i>	

	Page
LIX. The Phylogeny of the Cirripedia. By RUDOLF RÜDEMANN	511
LX. A new Species of <i>Platypodidae</i> from Pretoria, South Africa. By Lt.-Col. WINN SAMPSON, F.E.S.	515
LXI. On a new Species of the Genus <i>Perionyx</i> (Oligochaeta) from Tasmania. By J. STEPHENSON, D.Sc., Lecturer in Zoology, Edinburgh University.	546
LXII. On the Mammals collected in the Desert of Central Arabia by Major R. E. Cheesman. By R. E. CHEESMAN and MARTIN A. C. HINTON	548
LXIII. Some Notes on the Genus <i>Apus</i> (Crustacea Branchiopoda). By ROBERT GURNEY.	550
LXIV. New Species of Nematocerous Diptera from Fiji and Trinidad. By F. W. EDWARDS	568
<i>New Books</i> :—British Waders. By E. C. ARNOLD	574
The Animals of New Zealand. By Capt. F. W. HUTTON, F.R.S., and JAMES DRUMMOND, F.L.S.	575
Proceedings of the Geological Society	576

NUMBER 84.

LXV. Descriptions and Records of Bees.—CIII. By T. D. A. COCKERELL, University of Colorado	577
LXVI. Papers on Oriental <i>Carabidae</i> .—XIV. By H. E. ANDREWS	585
LXVII. The Ancestrula of <i>Membranipora pilosa</i> , L., and of other Cheilostomatous Bryozoa. By ARTHUR WM. WATERS, F.L.S., F.G.S. (Plates XVIII. & XIX.)	594
LXVIII. Descriptions of Two new Species of <i>Teinobasis</i> (Odonata). By the late HERBERT CAMPION.	612
LXIX. Reproduction of the Aquatic Oligochaete, <i>Nais paraguayensis</i> , Mich. By K. S. PADMANABHA AYYER	615
LXX. A new Genus of <i>Pamphaginae</i> (Orthoptera) from the Angola Coast. By B. P. UVAROV, F.E.S.	617
LXXI. Two new Silurids from Lower Congo. By EINAR LÖNNBERG, F.M.Z.S. &c.	619
LXXII. Note on the Synonymy and Distribution of <i>Tetranychus telarius</i> , L. By STANLEY HURST.	621
LXXIII. Description of a new Agamid Lizard from Sumatra. By H. W. PARKER, B.A.	624
LXXIV. Brief Descriptions of new Thysanoptera.—XIV. By RICHARD S. BAGNALL, F.R.S.E., F.L.S.	625
Index	641

PLATES IN VOL. XIV.

- PLATE I. { Tertiary fossils from the Jordan Valley
 II. {
 III. New species of *Cucumaria* from Monterey Bay, California.
 IV. N. American Oligocene Decapods.
 V. Jurassic Otoliths.
 VI. *Anguilla* Tertiary Decapods.
 VII. Sections of Capsule of *Acanthina*.
 VIII. *Psocus saghalensis*, sp. n.
 IX. *Pontobdella loricata*, sp. n.
 X. *Pontobdella aculeata*, sp. n.
 XI. *Helobdella nociva*, sp. n.
 XII. *Placobdella undulata*, sp. n.
 XIII. *Placobdella fulva*, sp. n.
 XIV. *Paraclepsis prosatrix*, sp. n.
 XV. *Paraclepsis vulnifera*, sp. n.
 XVI. *Raoiella indica*, gen. et sp. n.
 XVII. 1-4. *Tetranychus fijiensis*, sp. n. 5-10. *Paratetranychus*
 iseilemæ, sp. n. 11, 12. *Paratetranychus ununguis*.
 13-18. *Tetranychus* (*Schizotetranychus*) *hindu-*
 stanicus, sp. n.
 XVIII. { Ancestrulae.
 XIX. {

THE ANNALS

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[NINTH SERIES.]

“..... per litora spargito museum,
 Naiades, et circum vitreos con idile fontes:
 Pollucæ virginis teneros hinc eripite flores:
 Floribus et pictum, divæ, replete cænistrum.
 At vos, o Nymphæ Craterides, ite sub undas;
 Ite, recurvato variata corallia trunco
 Velite mucosis e rupibus, et mûli conchas
 Fertile, Deæ pelagi, et pingui conchyliis succo.”

N. Parthian Grænnellasi, Ecl. I.

No. 79. JULY 1924.

I.—*Notes from the Gatty Marine Laboratory, St. Andrews.*—
 No. XLVI. By Prof. M'INTOSH, M.D., LL.D., D.Sc.,
 F.R.S., &c.

1. The Occurrence of Opercular Development in *Mercierella enigmatica*, Fauvel, a new British Serpulid.
2. Preliminary Notice of a Second Contribution to the Marine Polychæta of South Africa.

1. *The Occurrence of Opercular Development in Mercierella enigmatica, Fauvel, a new British Serpulid.*

Mercierella enigmatica is a Serpulid recently described by Prof. Fauvel, and an exhaustive account of which, with text-figures, has been given in the Bulletin Soc. Zool. de France, t. xlvii. p. 121. It has also been described, with text-figures, in an interesting paper by Mr. Carmichael Munro, of the British Museum, in the 'Annals and Magazine of Natural History' for January 1924, so that further systematic details are at present unnecessary. Its occurrence on a barge in the London Docks makes it an addition by Mr. Munro to the British Fauna. Neither author, however, alludes to the fact that, like some Spirorbids, it

possesses opercular development, the soft rounded operculum (which Mr. Munro aptly compared to a fig) acting as a brood-pouch, and containing a considerable number of ova in an early stage of development in September 1923. The soft nature of the operculum may simplify the transmission of the ova to the brood-pouch. Moreover, the structure of the collar-bristles and the increase of the thoracic (parathoracic, *Caullery*) bristles to seven pairs and other features give an approach to certain Spirorbids, whilst the hooked spinous processes of the operculum are akin to those of *Hydroules*. I am indebted to the courtesy of Mr. Munro for specimens.

2. Preliminary Notice of a Second Contribution to the Marine Polychæta of South Africa.

In a previous contribution* to the Marine Polychæts of this region, 39 species were mentioned, belonging to the families Euphrosynidæ, Polynoidæ, Sigalionidæ, Phyllocididæ, Syllidæ, Nereidæ, Eunicidæ, Chlorocomidæ, Chætopteridæ, Ariciidæ, Cirratulidæ, Hælmintidæ, Maldanidæ, Hermellidæ, Amphictenidæ, Terebellidæ, Sabellidæ, and Serpulidæ. The present series is considerably more extensive, since examples of all the foregoing families are present, with the exception of the Amphictenidæ, and embracing about 81 species and adding the families Amphinomidæ, Aphroditidæ, Acœtidæ, Hesionidæ, Glyceridæ, Opheliidæ, Spionidæ, and Ammocharidæ, and thus introducing various interesting forms. Moreover, many species familiar in British and European waters likewise extend to the seas of the Cape, their altered surroundings giving rise to certain variations. Amongst those who have studied the South African Polychæts are Schmarda †, Ehlers ‡, Marenzeller §, and Willey ||, so that considerable advances have been made. The present collection, as in the first-mentioned one, is due to the energy of Prof. Gilchrist, of the University of Cape Town, whose surveys of the waters of the Cape in the interests of the Fisheries have been so successful.

EUPHROSYNIDÆ.—It is interesting that hitherto only one species, viz., *Euphrosyne capensis*, Kinberg, has been found, but in considerable numbers, ranging from the littoral zone

* 'Marine Investigations, South Africa,' vol. iii. No. 19 (1903).

† Neue Wirb. Thiere, l. ii. (1861).

‡ Königl. Gesell. Götting. Bd. iii. (1894).

§ Denkschrift. Mat. Nat. Cl. Akad. Wien, 1879.

|| Trans. Linn. Soc., Zool. vol. ix. p. 255.

to fairly deep water, those between tide-marks, according to Prof. Willey, being of a brick-red colour. Few parasites seem to attach themselves to this form, notwithstanding the cover afforded by the bristles and branchiæ.

The AMPHINOMIDÆ are in greater variety. Thus *Amphinome rostrata*, Pallas*, ranges from the Cape and the Atlantic to the various waters of the Pacific. *Eurythoe capensis*, Kinberg, a shore or shallow-water form, comes from Portuguese East Africa, the head presenting a small though elongated caruncle without lamellæ, a short lancet-shaped tentacle with a cirrophore below it, and two reddish eyes on each side. It is about two inches long and with the bristles $\frac{1}{4}$ inch in breadth. A typical segment presents dorsally a prominent division, almost as distinct as in *Nephtys*, bearing the dorsal bristles, which are of three kinds: (1) a transparent stoutish form, shorter than the majority with a secondary spur, which in some has the appearance of a shelf formed by the abrupt diminution of the terminal piece; (2) numerous very long slender bristles with a hair-like tip of considerable length, and a minute spur at its commencement; (3) stouter pointed bristles, fewer in number, with bold serrations. The dorsal cirrus, again, rises from a basal cirrophore as a short, tapering, lanceolate process. Close to the inner side of the dorsal bristles are the inconspicuous branchiæ, forming a tuft of slender processes arising from several short stems which divide into filaments, these again here and there giving off branches. The ventral bristles are shorter and stouter, though equally transparent, or in some tinted yellowish distally by transmitted light, the smooth tips are shaped like a knife-blade, and with a short spur at the base. *Eucarunculata grubei*, Malaquin and Deshorne, was procured in shallow water (1-4 fathoms) at Inhaca (Portuguese East Africa). About $1\frac{1}{2}$ inch in length, and with a breadth of $\frac{3}{8}$ inch. It is distinguished by numerous longitudinal brown lines along the entire dorsum and on the anterior third of the ventral surface, whilst the branchiæ form a large tuft immediately behind the dorsal division of the foot, and are evident laterally as well as dorsally. The head bears a short subulate median tentacle, two short lateral tentacles, and somewhat larger palpi inferiorly. The pads in front of the mouth are small. The caruncle is split laterally into a series of lamellæ passing obliquely outward and backward from

* *Vide* Ann. & Mag. Nat. Hist. ser. 9, vol. xii. p. 90 (1923).

the narrow median ridge. Indistinct eyes appear on the head in front. In section the body is more or less rectangular, though flattened. The foot has a dorsal cirrus with a long cirrophore and a slender tapering terminal portion; and a short ventral cirrus of similar shape. All the bristles are soft and flexible, and many had been removed by the apparatus for capture. The dorsal bristles are slender, elongate, transparent forms of various diameters, ending in a simple hair-like extremity of great tenuity, and of a few stouter with a finely serrate edge. The majority of the ventral bristles are proportionately stout with a slightly hooked tip. A few longer forms of less diameter are amongst them, with a delicate probe-like tip (by no means sharp), the edge for a short distance being serrated. Dr. Horst* points out that this species was first recognized by him under the name *Pherecardia lobata* in his 'Notes from the Leiden Museum,' vol. viii. MM. Malaquin and Dehorne had overlooked this when they renamed the anuclid in vol. xv. of the 'Revue Suisse de Zoologie' subsequently. Another *Eurythoe*, which has been named *E. assimilis*, was obtained in Portuguese East Africa, at Inhaca. The caruncle is small and smooth, the small median tentacle is in front, the lateral subulate and somewhat larger, the palpi about the same size; and all are in contrast with the larger anterior dorsal cirri. The pads in front of the mouth are narrow and long. The body is soft and much flattened, and is tapered posteriorly to a blunt tail which ends dorsally in a prominent anal cup. It is about 88 mm. in length, and the breadth over the bristles is 15 mm. The typical branchiae lie to the posterior and inner side of the bristles, and do not show laterally. The conspicuous dorsal bristles form a dense tuft and consist of long, straight, barbed forms, the shafts remaining nearly cylindrical to the long tapering tip, the barbs on which pass some distance down the shaft. The large number of these bristles is a feature. Mingled with them are still longer and much more slender forms with the distal shoulder and the delicate hair-like tip. The subulate dorsal cirrus expands a little beyond the cirrophore, and then tapers distally. The ventral bristles are of moderate length, the stout shaft expanding as the dorsal outline bends outward at the fork, the longer distal limb tapering to a blunt point slightly tinted yellow. This form resembles *E. capensis*, but the forked ventral bristles have a longer arm beyond the spur.

* Zool. Anzeiger, Bd. xxxiv. No. 10, p. 209.

In the *Chlæia* group are two species, the first, *C. gilchristi*, having been dredged in 150 fathoms in mud. It is of considerable size, measuring about 50 mm. in length and 20 mm. in breadth. The dorsum is dull brownish with a trace of yellow from the golden bristles. The head is small, the tentacles normal, and the caruncle also small and free posteriorly, whilst it is grooved on its upper surface and furnished with a series of lobate papillæ, largest in front, and which spring from the edges of the lamellæ into which it is cut transversely. The body is fusiform with a fringe of the long ventral bristles on each side. Posteriorly it ends in a pygidium with a dorsal anus and two slightly clavate cirri. The typical segment has the double row of rather short densely ramose branchiæ of a triangular outline. To the exterior is the firm papilla from which the dorsal bristles spring, whilst posteriorly is the very long dorsal cirrus (with its long cirrophore), the distal half of which is of a rich brown colour. At the ventral edge is a tuft of long silky bristles, the ventral cirrus arising from its base posteriorly. The dorsal bristles are of two kinds, a stronger series with the typical *Chlæia* transparency and a very slender series of similar character, both having the tips simply pointed. Before being mounted in Farrant the larger forms appeared to be serrated, but this disappeared in the solution, as also did much of the brownish colour, yet a prolonged search disclosed distinct serrations in a few. The long, slender, silky ventral bristles are more uniform in size, and all ended in delicate, simple, yellowish tips. A stronger and somewhat shorter yellowish series is mingled with the former. No trace of serrations or of a spur was present in any, their smooth outline being characteristic. The soft silky condition of all the bristles is noteworthy. The rarity of serrate bristles of any kind in this form is interesting, and so with the comparative length of the spur and that of the straight slender tip. The second species is *Chlæia candida*, Kinberg, which was procured in the Cape area in 36 fathoms on sand and stones.

APHRODITIDÆ.—No form is more widely distributed or in greater numbers in the waters of the Cape than *Aproditia alta*, Kinberg, the dorsum of which is covered with a tough layer of dark grey felt, beyond which the brownish ventral bristles are conspicuous, whilst parasitic growths and fragments of various kinds are intermingled with it. The larger, long, glistening bristles of the dorsum end in a slight hook, and the slender capillary forms have a similar termination.

The ventral bristles are stout, dark brown, iridescent organs, the stoutest ending in a blunt point with a brush of hairs on the sides, the more slender ventral had a distinct curvature, and the tip was prolonged as a sharp spike either straight or bent like a hook, and each enshrouded in hairs. Horst, whilst rightly criticising the multiplication of the genera of Polynoids, follows Roule in instituting the genus *Aphroditella* for forms like the present, yet the main features of the group remain so constant that it is doubtful if the addition of a brush of hairs to the ventral bristles is worthy of generic prominence. The largest example had fully three-fourths of its ventral surface infested with a minute Athecate zoophyte like *Coryne*. The other members of the family in the collection are *Hermione hystrix*, Savigny, and *Laelmatonice filicornis*, Kinberg, both likewise occurring in British waters.

The POLYNOIDÆ are much in evidence. Additional examples of *Lepidonotus wahlbergi*, Kinberg, occurred between tide-marks and in shallow water. In the previous report remarks* were made concerning its relation to *Lepidonotus clava*, Montagu. It seems to have a wide distribution in the waters of South Africa. Prof. Willey considers it to be identical with Stimpson's *L. semitectus*, as procured by Marenzeller at Angra-Pequena. *Eunoa assimilis*, sp. n., was dredged at a depth of 1010 fathoms, and its head has a little dark pigment but no distinct eyes. The median and lateral tentacles and the cirri have short clavate papillæ, whilst the palpi are also minutely papillose. The body has 36 or 37 segments, and is tapered posteriorly. No scales were present. The dorsal division of the foot carries a cirrus which tapers to a slender tip without enlargement, and is supplied with scattered papillæ. The bristles have sharper tips than those of *Hemilepidia erythrotania*, and the minute spines are more easily seen, whilst the bristles themselves are stouter as well as longer. Both dorsal and ventral spines project far outward amongst the bristles. The ventral bristles are also stouter than in the species mentioned and they terminate in a finer, slightly hooked point. Moreover, a single delicate bristle with a slender, elongated, tapering and serrated tip occurred at the dorsal edge of the series. The short, subulate, ventral cirrus showed a few clavate papillæ. Certain scales occurred in the tube, though their connection with the annelid is uncertain. All were somewhat ovoid in outline and had a broad belt of small papillæ

* Marine Investig. South Africa, vol. iii. p. 25.

along the incurved posterior border. The simple hooked tip of the ventral bristle resembles that of *E. turtoni*, but the tips of the dorsal diverge. Another interesting species, *Eunoa agnæ**, sp. n., was found on an Alcyonarian living on a bottom of sandy mud. The head has four comparatively large eyes on the dorsum, the anterior the larger. The proboscis is extruded with a papillose border and dorsal and ventral brown teeth. The body is rather elongate, about 1½ inches with a maximum breadth of ¼ inch, tapered anteriorly but more distinctly so posteriorly, and having 78 bristled segments. The tail is incomplete. No scales, cirri, or other processes remained on the specimen. The dorsal bristles are stout, transparent, and sharp-pointed. They spring from a narrow base, dilate a little in the shaft, and are slightly constricted below the tip, which has the aspect of a bellied and pointed knife-blade. The serrations on the ventral edge are very minute; three or four of the bristles are much larger than the others. The spine has a sharp point. The ventral bristles are long, pale yellow, and the shafts dilate into a rather broad tip which tapers to a simple point, 11 or 12 spinous rows occurring beneath. The smooth ventral cirrus has a long, finely tapered tip. The absence of scales or other processes of the *Eunoa* on the Alcyonarian or in the vessel would suggest an accidental association, yet, if the remark about luminosity is correct, the companionship may not be without meaning at this depth. *Eunoa macrophthalma*, sp. n., likewise comes from great depth (1200 fathoms) on *Globigerina* ooze. The softened head is distinguished by the presence of two large ovoid pigment-patches (like connate eyes) covering most of the surface of each dorsal area. The median tentacle is absent, the lateral small and subulate, and the tentacular cirri are also devoid of any terminal enlargement. The palpi are slender and very long. The body is about an inch in length, is rather narrow, tapering a little in front and more distinctly posteriorly, where the dorsal cirri are of great length and slenderness. The scales are diaphanous, irregularly rounded with a smooth edge, a limited area to the inner side of the scar being covered with microscopic papillæ. The dorsal bristles are stoutish, slightly curved, and sharp-pointed with fine rows of spikes. The ventral have shafts of moderate strength, dilating at the tip and then diminishing to a very long, somewhat hooked, and sharp extremity. *Polynoe caput-leonis*, sp. n., was procured in the shrimp-trawl from 250 to

* Named after my late sister, my companion for 80 years.

500 fathoms off Lion's Head. The head is comparatively small, with two large eyes on each side situated close together and posterior in position, as well as rather lateral than dorsal. All the appendages have been removed, apparently by the use of too strong formalin. The single palp in the vessel is long, tapering, and smooth. The body is fully 35 mm. long and, about 11 mm. across the bristles, is fusiform, especially from marked diminution anteriorly. The scales are large, rounded or ovoid, with smooth edges and a series of minute papillæ on the anterior and inner borders. *Polynoë scolopendrina*, Savigny, is common in the seas of the Cape, but no mention is made of the forms with which it is a commensal. The entire dorsum of that from No. 70 was dotted with swarms of *Loxosomæ*, groups occurring between the feet and passing to the ventral surface, over which they were likewise scattered. They especially frequented the segmental grooves leading from the feet to the middle line, the larger forms asserting themselves where there was most aeration. The examples of this species from the Cape show several well-marked variations from the ordinary type seen in Britain. Thus the javelin-shaped bristle above the spine in the ventral division of the foot has a more elongated tip and bears minute spikes on one side. Occasionally a second and more spinous bristle adjoins it. The bifid bristles which follow have more elongated tips and sharper distal divisions. The dorsal bristles, moreover, are more attenuate distally, since they taper to a delicate extremity and the probe-pointed tip with the split so characteristic of the British form is seldom seen. The example from No. 1 is laden with large ova which passed into the feet. The bristles of Ehler's *Polynoë granulata* from the Tortugas closely resemble those of this species, though the papillæ on the posterior area of the scales differ. A form, which has been termed *Parmenis reticulata*, sp. n., from Polaris Beach in Portuguese East Africa, shows a head characterized by the large size of the eyes, the posterior pair being nearer each other than the anterior. The median tentacle is absent, but the lateral are short and subulate. The palps are long and covered with minute clavate papillæ. Each peak in front had a speck of dark pigment. The body is comparatively small, resembling *Evarne impar*, Johnston, in this respect. The first scales covering the head are rounded, but by-and-by they become ovoid and then reniform with long cilia on the external border. What is diagnostic, however, is the presence of hexagonal reticu-

lations throughout their entire extent. These are smaller and more distinctly hexagonal at the inner border, larger and less regular toward the outer border, next the long cilia and where a larger tubercle occurs in the centre of each. Whilst the larger spaces toward the outer border and the centre have only a single large tubercle, the smaller spaces at their inner border have numerous small horny points. The rounded first scales are densely ciliated along the margin except at the attached edge, the cilia being longest externally. The free margin of the scale shows large, more or less hexagonal areas each with its long, slightly tapered process with the spinous tip. Toward the translucent edge the hexagonal spaces are much diminished, and the spines smaller and more numerous. When compressed under a cover-glass the spines appear as circles from the contour of the base. The pale brown dorsal bristles, which form a dense tuft, are stout, finely serrate, and have a long tapering tip, only a few at the edges have a shorter tip. They are characterized by their great length, straightness, and comparative slenderness. These bristles thus wholly differ from those of *Evarne impar*, Johnston, which have a notch at the tip, as also have the ventral bristles, which present long shafts dilating at the distal end, then the tip with its spinous rows tapers to the smooth terminal region which has a slightly forked end and a spur at its base. The length of the terminal portion is characteristic. A few at the upper and lower edges have simple tips. The ventral cirrus is subulate with numerous clavate papillæ. The feet contained many mature ova. The dorsal bristles of *Parmenis ljunghmani*, Malmgren, are spinous almost to the rather slender tip, and the same bristles in *P. capensis*, Willey, so far as the figures go, appear also to be slender. The ventral bristles, again, are characterized by their slender shafts, somewhat short spinous tips, the secondary process of the bifid tip passing upward with little divergence. On the whole, the present form appears to differ, the slender shafts and bare tips of the dorsal bristles being diagnostic. A form which approaches this is *Lagisca irritans*, Marenzeller*, which occurred on a Hydrocoralline procured during the dredging of the U.S.A. ship 'Albatross.' The large eyes and the bristles are similar, but the scales differ. Areolated scales occur in several Polynoids, such as *P. areolata*, Grube, *Lepidonotus carinulatus*, Grube, and in those of *Iphione* and *Euphione*.

* Bull. Mus. Comp. Zool. Harvard, vol. xliii, No. 3 (1904).

Euphione elizabethæ, M'I.*, occurs at various stations at the Cape as well as in Portuguese East Africa, the examples from the latter being small. All are characterized by the coarsely hirsute tips to the ventral bristles. In the largest example 13 pairs of scales occur, and their processes show much variety. Thus, the capstan-like processes have the rays hard and clear as if friction and age had affected them; whereas in others the "heads" are rounded, the rays devoid of the spiked edges, and in many in greater numbers (16 or 17 against 9 or 10), and the papillæ themselves are more numerous. Some, again, present scales covered throughout with small papillæ, only a few projecting on the anterolateral border of the first and the lateral edge of the others. In a few smaller examples the capstan-like papillæ had sharp horny rays with a central spike directed upward, so that this condition is not due to age. In *Harmothoe tuberosa*, Ehlers, a homologous condition (hairy tips) affects the dorsal bristles, whilst the ventral are normal. It comes from the South Polar region, and is described respectively by Ehlers and Benham from the collections made by the German and the Australian Antarctic Expeditions. *Maxillicephala mirabilis*, M'I.†, is not uncommon on a bottom of sand and mud in 300–500 fathoms in Cape waters. This is *Oligolepis violacea*, Levinson‡, published a year after the issue of the 'Challenger' Annelida. He, however, figures the ventral bristles with a distinct hook at the tip, a condition not seen in any of the forms which have come under notice. The species stretches from the Arctic seas at Greenland southward to the Atlantic at the Azores and the coasts of Africa, whilst from the Kara Sea it extends to the Pacific and the waters of New Zealand. Several new species have lately been described by Fauvel from the Atlantic and the Bay of Biscay, but figures of the bristles are still desiderata.

Under the Family ACÆTIDÆ is *Panthalis ærstedii*, var. *capensis*, which was procured by the large trawl at a depth of 25 fathoms off the Cape. The small head resembles in general aspect that of *P. ærstedii*, the little median tentacle arising behind the base of the ocular peduncles, and passing forward as a tapering organ considerably in front of these. The tapering lateral tentacles arise beneath the peduncles, are thicker and longer than the median, and are marked by a deep brown spot about a third of their length from the

* 'Challenger' Annelids, p. 63, pls. ix., xvii., & xviii.

† Id. p. 121.

‡ Kara Havets Ledorme (Dijmphna Toget. Zool.), 1886, p. 4, Tab. 25, figs. 1–4.

base. The palp is a tapering organ, not of great length, two-thirds of its surface having a smooth, tough, cuticle, then the tip is bristled with subulate papillæ which diminish a little at the abruptly conical extremity, which is smooth. The tentacular cirri are of moderate length, and have a brown spine at the base. The body measures 3 inches, but is imperfect posteriorly, and probably in life reached 4 or 5 inches or more. It is rounded dorsally, flattened ventrally, and abruptly tapers anteriorly. The centre of the dorsum is bare, the smooth scale being confined to the sides except the first and second, which shield the cephalic region. The first foot, as in the British form, has two long spines, the larger passing to the ventral and the smaller to the dorsal division, the latter and the fissure carrying a dense series of slender, curved, tapering bristles of great tenuity, the tips being minutely spinous. The smaller group springs from the edge of the large lobe, and consists of one or two stout bristles, the distal end of the shaft dilating and being furnished with bold spines, then tapering to a long hair-like process with minute spines—the extremity being smooth. The ventral cirrus is considerably longer than that of the second foot. The foregoing thus differs from the European *P. ærstedii*, especially as regards the large tuft of bristles, which is spread out like a curved fan. The second foot carries a tapering dorsal cirrus, which extends as far as the tips of the bristles. Then follows the smaller lobe, which has now assumed a dorsal, instead of a more or less anterior, position, and carries the broad fan of the longer bristles, whilst the ventral division bears a tuft of spinous bristles considerably shorter and stouter than those of the first foot. The ventral cirrus is about half the length of the ventral lobe. The third foot has the large brown bristles more in evidence—six or eight projecting above the serrated forms in the ventral division. The tips of these strong bristles are slightly dilated, then tapered towards the tip so as to be spear-like, the tip being rather blunt and flattened, with a row of short spines, or in others a group of spines. Further, some at the ventral border (amongst the stouter serrated forms) have a hairy whip projecting from the dorsal edge of the bristle, its base being enveloped by the terminal tuft. In the typical foot the distinctions between the European and British forms are:—the diminution of the terminal whip of the strong ventral bristles so that only the terminal forms remain, and in lateral view they pass from the convex ventral edge of the tip, leaving a bare blunt extremity beyond. They thus approach the condition in a

Polynoid, especially as the tip is slightly curved and diminishes distally. The shortening of the serrated bristles at the ventral edge and the bold curvature of their tips are also noteworthy. The serrated dorsal bristles, again, at the upper edge are of a different type from the inferior series, for they have straight tips and much more delicate and longer hair-like spines. In the posterior feet this (upper) tuft is much reduced and is often absent. The scales are smooth, and, as transparent objects, show minute reticulations over a large area in the centre. The example is a female—laden with large ova, which distend the feet. The small differences in some species of *Panthalis*, described from foreign waters, suggest the view that perhaps they may be varieties of *P. ærstedii*. Fauvel has united *Euarche tubifex* of Ehlers with *Eupanthalis kinbergi*, M'I., and the resemblances with *Panthalis ærstedii*, perhaps, make the more familiar name appropriate. No brush-shaped bristles occur in *Eupanthalis kinbergi* which has dorsally the long serrated forms with the enlargement at the commencement of the spikes, and which differ from the regularly serrated forms of *P. ærstedii*. Then come the stout bristles with a short hook at the tip, whilst at the ventral edge are more of those with the spindle-shaped tips. In *Eupompe grubei*, Kinberg, an acute process occurs at the tip of the stout bristles, and the spinous (feathered) bristles appear to be shorter than in *P. ærstedii*.

A remarkable tube of a *Polyodontes* occurred in the Cape waters at a depth of 112 fathoms on a bottom of mud and sand. Unfortunately, only 14 inches of the anterior end was secured, the diameter being about two inches. No portion of the inhabitant was found. The tube is composed of delicate fibres felted together in the most wonderful way, and externally consists of two regions, the anterior (6 inches) of transverse rows of tufts of glistening fibres of a pale stone-colour—such in all probability indicating the successive edges of the mouth of the tube. The rest of the tube differs in aspect, being somewhat smoothly felted, marked by transverse wrinkles, and devoid of the tufted silky appearance of the anterior. The fibres forming this region are finer. The interior of the tube is soft and smooth. The only bristle obtained is a slender, long, cylindrical one, with a dilatation and a brush of hairs at the tip, identical with one of those found in another remarkable tube in the British Museum from Porto Rico, Cuba, and which, slightly less in diameter, is 4 feet 6 inches in length. Both evidently pertain to *Polyodontes* *.

The SIGALIONIDÆ are represented by *Sthenelais boa*, Johnston, in the large trawl, from a depth of 33 fathoms, the example being small. The range of this species is great, and that without any variation worthy of note, viz., throughout the northern seas, the Atlantic, and the Mediterranean. *Sthenelais dendrolepis*, Claparède, again, came from 36 fathoms on a bottom of sand and stones. The head has two connate eyes on each side, the appendages being absent, except a simple, long, tapering, and smooth palp. About 40-50 segments of the anterior region represented the body, the dorsum being marked by russet-brown pigment. The scales somewhat resemble those of *S. buskii*, M'Cl., but the papillæ (about twelve in number) on the outer edge differ, the main stem in each giving off about seven long filaments from its tip, in the middle of the body, those in front having fewer. These processes thus differ from those of *S. mathildæ**, *S. buskii*†, and *Sigalion pourtalesii*, Ehlers‡, in which the filaments arise from the sides of the main stem. The feet and bristles are longer and more prominent posteriorly than anteriorly. Papillæ occur both dorsally and ventrally, and differ in shape from those on *S. boa*, being broad and almost foliaceous on the ventral division. The dorsal bristles are more slender than those of *S. boa*, and the free edge of the setigerous lobe differs. The upper bristles are somewhat stronger than the inferior, and have a characteristic curve, whilst the shaft is long and slender, the tip slightly flattened and minutely serrated. The ventral bristles are in three groups, an upper slender series with shafts dilated, spinose distally, and long terminal pieces of three joints, the basal being about double the length of the conjoined distal segments. The tip is minutely bifid and winged. In the central and larger series the shafts are stouter and more roughly spinose distally. The terminal pieces have a curved claw or hook distally, a straight secondary process, and a wing. In the slender inferior series the ends of the shafts are more or less smooth, and the terminal pieces consist of a long basal and two distal joints, the tip being bifid and winged, as in the upper series. The foot anteriorly is provided with a large web-like flap and a large flattened cirrus. Although it is probable that Delle Chiaje § referred to this species, his *Sigalion vittatum*, yet,

* Brit. Annel. (Ray Soc.), vol. i. p. 427, pls. xxix., xxxi., xxxiv., & xli.

† Id. *ibid.* p. 481, pls. xxvi., xxix., & xxxiv.

‡ Rept. Annel. 'Blake' (Pourtales), p. 57, Taf. xv. & xvi.

§ Mem. iv. p. 155, tav. 57, figs. 13 & 14, and Descr. c. not. vol. v. pp. 58 & 108, tav. v. figs. 13, 14 & 16.

as Claparède * observes, it is not possible to be certain, for his artist has taken liberties in the various figures. Kinberg's *Sigalion edwardsi* †, from La Plata, has papillae with short filaments, but they are unlike those of the present form, the main stem being broad and the few short processes arising from its upper region. *Leanira hystrix*, Ehlers, was obtained at various depths from 205 to 1200 fathoms on a bottom of muddy sand or *Globigerina* ooze. Besides the shores of Britain, this species has a wide distribution in the Atlantic, and now reaches the Cape. *Sthenelais simplex*, Ehlers, is evidently a *Leanira*, and approaches the present form.

Family Phyllodocidæ.

Subfamily ALCIOPIDÆ.

Vanadis formosa, Claparède, was captured at the surface off the Cape (Station 298), one end enveloped by a Medusa, probably after being enclosed in the net, a feature so common in British waters. It is a slender elongated Alciopid (about 4 inches, but incomplete), and marked at intervals by dark brown, cushion-like spots placed behind the feet, whilst it terminates posteriorly, behind the last two brown spots, in a single elongated cirrus of a brown colour and proportionally thick. The anterior region is absent, and little change occurs in the diameter of the body from one end to the other, the pigment-spots do not seem to be perfectly regular, for the number of segments intervening between them varies from three to five, three being the most common number. The number of the spots likewise varies, a pair (one on each side dorsally and ventrally), two pairs, and three pairs occur along the body. They are proportionally large, each forming a brown cushion joined laterally to that below it. Two pairs occur on the penultimate and last segments, but they form a single, large, lateral cushion in each case, visible both laterally and ventrally, whereas, in some of the anterior segments, two occur dorsally and two ventrally. The segments, as a rule, are narrower in front and widen posteriorly at the feet, so that the slender body has a moniliform aspect. The caudal process has at its base a pair of feet with lanceolate lamellæ, whilst at its tip are two small subulate cirri. The feet are

* Annél. Nap. p. 99, pl. iv. fig. 4, and pl. v. fig. 1.

† Öfvers. Kongl. Vet.-Akad. Förh. Arg. 12, nos. 9 & 10, 1855, p. 387, and Freg. Eugen. Reza, Taf. ix. fig. 41.

composed of a setigerous process, tapering to a slender extremity and supported by a long translucent spine, the end of which is often slightly hooked, besides a dorsal and ventral lamella—leaf-like in outline. The bristles are transparent, simple and hair-like in tenuity, and apparently smooth. The papilla at the tip of the foot was not seen, but the specimen was unsatisfactory as regards preservation. *Vanadis formosa* is widely distributed in the Atlantic, Pacific, and Indian Oceans, as well as in the Mediterranean. Another pelagic form is *Travisiopsis capensis*, sp. n., which was found in the tow-net over a depth of 600 fathoms, the bottom being sand and *Globigerina* ooze. This is an olive-coloured soft form, about 15 mm. in length, nearly cylindrical throughout, but tapered a little at the tail. The anterior end is somewhat truncated, and the region behind is slightly swollen. On the left front it bears a short, thick, conical process with an acute point. Behind is a small papilla, possibly the ceratophore of a tentacle, and following this is a longer process or tentacle. No corresponding parts occur on the right side, which may have been injured. The mouth is obliquely ventral in position and forms a circular aperture. The dorsal and ventral surfaces of the body are convex—so that it is more or less rounded. A longitudinal median streak occurs ventrally, and fine, but faint, transverse striae occur on the surface. Along the sides are ranged about eighteen blunt feet, each with a dorsal and a ventral thick lamina, and a less-developed intermediate one—slightly anterior. The foot contains three translucent bristles—wide at the base and tapering to a sharp point. The body-wall seems to enclose an empty space. This form does not appear to correspond with Levinson's *T. lobifera**, or with either of the species, *T. lanceolata* and *T. levinseni*, found by Southern† off the west coast of Ireland, the lobes of the feet and their arrangement apparently diverging. The condition of the example, however, is unsatisfactory.

Family Hesionidæ.

Hesione pantherina, Risso, was found between tide-marks at Makala Bay. The body has sixteen bristled segments, with the elevated dorsal fillets occurring along the sides. The specimen is mature, and carries ova in the setigerous lobes of the feet. This is a pelagic as well as a littoral

* "Om nogle pelagiske Annulata," Kongl. dansk. Vidensk. Selsk. Skrifter, 6 Række, 6 Bd. (1885 6).

† Irish Sci. Investig. no. iii. p. 30 (1911).

form, extending from the Cape along the Persian Gulf to the Red Sea and the Mediterranean. From 190 fathoms, on mud, comes *Magalia cupensis*, sp. n., the head having two eyes on the prominences on each side. The palpi are of moderate length, slightly tapered distally, and with an articulation at the distal third. The tentacles are absent. The tentacular cirri resemble those of *M. perarmata*. The body is about 12 mm. long and 2 mm. broad, tapered anteriorly, and more distinctly so posteriorly, somewhat soft, and of a dusky greyish-brown colour. Tail injured. The biramous foot is of moderate length, with a pointed tip to which two spines go, a large and somewhat conical lobe at its inferior edge—external to the cylindrical ventral cirrus, which does not extend so far outward as the tip of the foot, but which has a slight constriction just within the rounded tip. The dorsal cirrus is very long, tapered, and segmented, and the ceratophore has bristle-like spines which terminate in fine hair-like ends projecting considerably beyond the tissues. A smaller papilla, also conical in shape, occurs at the dorsal edge of the setigerous process. The bristles form a broad fan, those with the longest tips being central, those with shorter dorsal and ventral, the broadest tips being ventral, and they are minutely bifid. The central series (compound) seem to have tips which possess only long delicate terminal pieces like simple hairs. The foot thus diverges from that of *M. perarmata* and *M. assimilis*, J. W. Pryde*.

In *Magalia inermis* (British Museum, Voyage, 'Discovery') the long tips of the central bristles are for the most part minutely bifid, though a few (seen perhaps on edge) seemed to be simple. The ventral cirrus presents no constriction below the end. *Syllides verrilli*, Percy Moore †, somewhat resembles *Magalia*, though the short, articulated, dorsal cirri and the club-shaped dorsal bristle differ.

Family Syllidæ.

A large and interesting form, *Trypanosyllis ingens*, Parlin Johnson, comes from Table Bay, where it does not seem to be uncommon, but every example is seriously damaged by the preservative fluid, most of the cirri having been removed. The head is typical. The body is about two inches in length,

* This able young observer fell in the last battle in South-East Africa, and thus a career of great promise was cut short.

† Proc. Acad. Nat. Sc. Philad., Nov. 1907, p. 458.

much flattened, tapered a little toward the anterior end, and more distinctly toward the tail, the pygidium having two subulate cirri. Anteriorly the dorsum is marked by brown bars. In two, where the body had been ruptured posteriorly, clusters of buds occurred at the ends. The foot is comparatively short, the tip being truncated, only a slight projection occurring at the upper edge where the spines emerge. It carries dorsally the long moniliform cirrus which tapers from base to apex, and ventrally a short cirrus of elongate-ovate shape, very little tapered distally. The bristles are short, stout, with striated shafts, somewhat dilated and curved distally, then diminished to a point, the longer (ventral) margin having articulated to it, by a long base, a short hooked terminal piece. The buds at various stages of development arise, not from the tip of the tail, but from the ruptured surface of the posterior region. It appears to be closely allied to *T. ingens*, of Prof. Parlin Johnson*, from Pacific Grove, California. The chief differences are the larger dorsal cirrus and the somewhat longer ventral cirrus. In *Trypanosyllis misakensis*, Izuka †, exactly similar budding takes place from the posterior end, but apparently from the structure of the bristles they do not become pelagic. In this form a secondary spike occurs on the terminal piece of the bristles, and thus it differs from the South African. It occurred in shallow water near Tokyo. The genus has a wide distribution both in the Atlantic and Pacific, as well as in the Mediterranean. A young *Syllis armillaris*, O. F. M., occurred amongst the tubes of *Hydroides*, a still more minute one, like a *Sphaeosyllis*, accompanying it.

Family Nereidæ.

Nereis (Mastigonereis) striata, Schmarda, was procured between tide-marks at Inhaca. The head is characterised by an almost continuous ocular band on each side, though three specks can be made out (on each side). It is wider behind than in front, and thus the pale region between the ocular rows has nearly parallel sides on the bluntly triangular head. The frontal tentacles and palps are normal, the latter having a little pigment on the distal end of the basal part. The upper tentacular cirri are very long, the longest reaching the posterior border of the 7th bristled segment. The inferior pair are smaller and shorter. The

* 'American Naturalist,' vol. xxxvi., April 1902, p. 295.

† Annot. Zool. Jap. vol. v. part 5 (1906).

body is comparatively short and thick, but the tip of the tail is absent; it reaches $1\frac{1}{4}$ inches. Across the middle of each segment dorsally a linear and somewhat interrupted band of pigment crosses from side to side, but toward the tail the bands are indistinct. On the ventral surface similar linear bands occur on eight or nine of the anterior bristled segments, a broader faint dusting of pigment characterising those behind—till the caudal region is reached, where the linear bands are again distinct. A pale belt is at each segment-junction, and a pale longitudinal median streak marks the nerve-cords. Seven or eight of the anterior feet have ventrally a large black pigment-spot, and this breaks up in the following feet into double rows of dots, then single rows to the tail. Dorsally each foot has two bold black specks, but toward the posterior end these have a tendency to be confluent. The 10th foot has two black spines, the dorsal cirrus is smaller than in front, and so is the upper pigmented lobe, whilst the cirrus is further out. Then follows a black spine and a tuft of homogomph bristles; a blunt lobe, less prominent than the former, comes next. Beneath is a second black spine and a tuft of heterogomph bristles, then a bluntly conical lobe followed by a small shoulder or boss—from which the small ventral cirrus arises: it does not reach the tip of the adjacent lobe. All the bristles appear to be small.

The chief changes are the carrying of the dorsal cirrus further out (37th foot), the diminution of the upper and other lobes. The process carrying the dorsal cirrus in the feet behind is still further extended outward (53rd foot), and the pigment-patch is large, the cirri are more slender and longer. All the lobes are pigmented. The example is a female distended with large ova, but no trace of the heteronereid condition is visible.

So far as observable, this form agrees with Schmarda's * *Mastigonereis striata* in the pigment-bars and the general structure of the feet, head, and bristles. He does not mention the eyes, but his figure shows small dots arranged in a square. Prof. Willey † states that the *Paragnathi* have the form of minute granulations characteristic of the genus *Platynereis*. His example came from Table Bay.

Nereis operta, Grube (= *Mastigonereis latipalpa*, Schmarda),

* Neue Wirb. Thiere, II. Hefte, p. 112, fig. 248.

† Trans. Linn. Soc., Zool. vol. ix. p. 262, pl. xiii. fig. 14, & pl. xiv. figs. 11 & 12.

occurred both at the Cape and in the waters of Portuguese East Africa, viz., at Torrér Point and Saldanha Bay—between tide-marks. The head is remarkable for its great antero-posterior diameter, the long flattened region in front of the eyes being noteworthy. The eyes are prominent and widely separated, but the pairs on each side are nearer. The paragnathi are:—(1) as two points, one in front of the other; (2) form an oblique double bar on each side; (3) a small group of five points; (4) a somewhat triangular series of points; (5) two rather large points, on each side of which are the double ring of the larger and smaller paragnathi. The body of the largest is a little less than 3 inches, and the reddish coloration approaches that of *Nereis zonata*, but without the distinct bands. It is characterised by the tenuity of the posterior region, where the long feet are prominent. The dorsal anus carries two long cirri ventrally. The 1st foot is remarkable for its great size. The 10th foot has two black spines, and the projecting upper lobe is somewhat triangular with the apex external, the enlarged inner part carrying the dorsal cirrus, which is larger than that of the 1st foot, the next is ovoid, and the ventral is elongate-ovoid. The upper and lower groups of homogomph bristles are normal, and the terminal pieces of the heterogomph are hooked and serrated. The changes behind consist of the pushing outward of the upper lobe and the dorsal cirrus, the more elongate condition of the middle and ventral lobes, and the formation of an upper and a lower division of the foot (still more marked at the 60th foot). There is little to distinguish this form from the *Neanthes capensis*, Willey, from Woodstock beach, Cape of Good Hope.

Nereis diversicolor, O. F. Müller, is represented by a small example from the shores of Port Mahon.

Family Eunicidæ.

This family, whilst readily distinguishable from other families, offers in the genus *Eunice* many sources of confusion, as indeed the number of new species in some recent contributions suggests. The bristles, usually reliable in other families for differentiation of species, present few features for diagnosis, whilst the external appearance, the dental apparatus, the gills, feet, and other points provide many puzzling variations. No doubt, the origin and structure of the gills give in some cases definite features, as also

do the tentacles, cirri, dental apparatus, and the outline of the feet, but occasionally, after much study, considerable doubt remains.

In the present instance *Eunice siciliensis*, Grube, comes from Cape waters at a depth of 36 fathoms on a bottom of sand and stones. The head is bilobed with five slightly articulated tentacles, the median longer than the others and tapered a little at the tip. It extends the antero-posterior diameter of the head beyond it, the adjoining pair spring in line with the former, have similar articulations, and are only a little shorter. External to their base is on each side a large and somewhat ovoid eye, the long diameter being antero-posterior. The external tentacles arise a short distance apart and form a transverse line in front of the rest. The nuchal tentacles are also moniliform and more distinctly tapered.

The basal part of the maxillæ (the carrier of Prof. Treadwell *) is short and the maxillæ strongly curved. The great dental plates have only two large teeth and a rudiment of a third. The lateral paired plates seem to have only a single tooth, with an accessory piece attached to it, and the unpaired was equally simple. The mandibles had their upper edges incurved so as to form half a tube.

The body is incomplete, the caudal region being absent, and measures 2 inches in length and 4 mm. broad in front; there is little difference in the diameter throughout. The branchiæ are so inconspicuous that at first sight they may be unnoticed. They do not appear until the 180th foot, or thereabout, when a short subulate process is found on the shorter dorsal cirrus. They increase in length toward the posterior end of the fragment, but always remain a simple filament. Grube observes that they arise after the 68th foot. The foot anteriorly has a subulate dorsal cirrus, the tip faintly articulated, then a tuft of rather stout, simple, finely tapered bristles, followed by the stouter compound forms, the terminal pieces being short, bifid, double-winged, and with a differentiation and a kind of spur or angle inferiorly. The dilated end of the shaft is minutely serrated on both edges. Posteriorly the foot is supported by a stout black spine, bluntly pointed and somewhat hooked. Ventrally is the sausage-like cirrus. In a complete example in the British Museum the gills posteriorly present about five long filaments.

* "Leodiciæ of the West Indian Region," Carnegie Instit. of Washington. vol. xv. p. 7.

Eunice depressa, Schmarda, was dredged in 8 fathoms E. of the Chefina Light. The close resemblance of this form to *Eunice tubifex*, Crossland*, who gives a careful account with figures, renders it unnecessary to give notes of both. *E. depressa* was procured at Isipingo. It is a remarkably elongated form with the branchiæ mostly developed posteriorly. The cephalic region is bilobed, with the usual five tentacles, the median scarcely longer than the adjoining pair, between which and the external tentacles is a small eye. The body is about 18 inches long, with a breadth at its widest part of 8 or 9 mm., and tapering posteriorly to end in a dorsal anus with two rather short cirri inferiorly. The branchiæ begin as small filaments about the 42nd foot, soon become bifid, trifid, and more complex as well as longer; their length, indeed, about 4 inches from the head being noteworthy, a main stem of four long filiform divisions springing from the small dorsal cirrus. This arrangement continues throughout a long region of the body, then a fifth slender filament is added. Toward the tip of the tail the diminished and flattened body bears these long lateral fringes in a characteristic way, and they only diminish towards the actual tip. It is interesting in connection with these long gills that in the region of their full development the perivisceral cavity was full of ova. Before the commencement of the gills the foot anteriorly presents a stout tapering dorsal cirrus, enlarged just beyond the cirrophore and supported by a bundle of spines, then a tuft of simple bristles with tapering tips and short narrow wings. On the whole, they have shorter and broader tips than usual. Below them are stout compound bristles with the dilated and flattened ends of the shafts and slightly curved knife-blade tips, broad at the base but tapered at the point. The brush-shaped forms (pectinate of some) have fairly symmetrical and broad extremities with numerous teeth and a longer filament at each side. Ventrally is a short conical cirrus arising from a glandular pad. As soon as the branchiæ are developed, two or three dark brown crotchets with winged and bifid tips appear below the simple bristles and brush-shaped forms. Moreover, compound falcate bristles appear inferiorly about the 30th foot. The tube (dried) is curiously nodulated and formed of a tough secretion, with various branches or diverticula. The rounded nodular excrescences here and there appear to have aided in accommodating the elongated annelid.

* Proceed. Zool. Soc. 1904, p. 303, pl. xxi. figs. 1-8, & text-figs.

Schmarda*, in his account of *Eunice depressa* from Auckland, New Zealand, in *E. teretiuscula* from Ceylon, and in *E. schemacephala* from Jamaica, indicates the occurrence of these tapering knife-shaped tips to the bristles. Finely tapered tips of a similar character were also described in *E. jeffreysii*, M'Intosh†, from the 'Porcupine.' Crossland‡, again, further extended our knowledge of the same type in the present species from Zanzibar, whilst Treadwell's§ *E. tubicola* (which closely resembles the latter species) has recently described the same features. The chief differences from *E. depressa*, Schmarda, are the more sparse divisions of the branchiæ throughout the greater part of the body.

Eunice vittata, Delle Chiaje, was obtained at Cape Natal and also at an unknown locality.

This form approaches *E. vittata*, so far as can be observed in the injured examples, though an accurate description is difficult. It differs, however, from the typical *E. vittata* in so far as the snout is rounded, and behind it are three short tentacles in a transverse row after the manner of Kinberg's *Amphiro* and *Lysarete*. In lateral view the snout is not flattened as in *Drilonereis*, and the dorsal cirri are fairly developed. Two short processes appear on the dorsum behind these. The anterior feet have a rather long, subulate, dorsal cirrus, with a slender extremity. The setigerous region is conical and is supported by two strong, pale brown spines. The simple upper bristles have very finely tapered tips. The compound bristles beneath have comparatively stout, though flattened, shafts, with curved and dilated ends, bevelled distally to a sharp point. The terminal piece is translucent with a boldly bifid tip which is comparatively long, the curve between the two points forming a semicircle as in *E. siciliensis*, though the bristle is much less. The posterior feet are much diminished, and have, in addition to the slender bristles, a powerful crotchet with a backward curve of the shaft, a bifid spur on the crown, and a large main fang beneath. It appears to have been in a sponge (no locality).

Eunice floridana, Pourtalès, obtained between tide-marks, Torrer Point. The head carries long and rather thick,

* Neue Wirb. Th. i. 2, p. 127.

† Ann. & Mag. Nat. Hist. ser. 7, vol. xii. p. 137 (1903).

‡ Proc. Zool. Soc. 1904, p. 303.

§ Publicat. Carnegie Institut. Washington, No. 312, p. 139.

smooth, blunt tentacles. The eyes are situated at the outer base of the lateral tentacles. Nuchal tentacles of considerable length and smooth. The maxillæ are little curved. The right great dental plate has five teeth and a process, the left has a gap (from injury) and three or four teeth; the unpaired four teeth. The mandibles are short and broad at the tip. The body is about $4\frac{1}{2}$ inches long, rounded in front, flattened posteriorly, and terminating in a dorsal anus with two ovoid cirri beneath. The branchiæ commence on the 12th or 13th foot with three or four divisions, and they continue nearly to the tip of the tail. At the 10th foot the dorsal cirrus is thick and long with two slender brown spines at its base. The upper simple bristles are in two groups, the dorsal longer and with a different curve, the lower with broader tips tapered distally and a more distinct curve. The compound bristles are flat and thin, the distal end of the shaft, which is slightly curved and minutely serrated, dilated, thin, bevelled, and the terminal piece of moderate length, winged to the base and bifid. The smaller distal hook is set at rather more than a right angle, whilst the stout, sharp, conical one beneath forms nearly a right angle with the edge beneath. A slight trace of the inferior spur is present in some. The ventral cirrus is bluntly conical. Two strong black spines support the setigerous region.

The 22nd foot has a less bulky dorsal cirrus which supports a branchia with ten unilateral pinnæ, somewhat limp in character, so that it folds and doubles readily. The setigerous region ends in a rounded extremity, and the massive ventral cirrus often curves downward at the tip. At the 30th foot the branchia has about the same number of unilateral pinnæ (10), and a bifid crotchet projects above the ventral cirrus which now forms a sharper curve. The dorsal cirrus at the 50th foot is longer and more slender, and the number of the pinnæ of the branchia fewer, whilst the ventral cirrus is longer, forming a pointed cone, but still has the inner glandular cushion. The simple dorsal bristles are longer and more slender, and the compound forms smaller. The pale brown spines still support the dorsal cirrus, and the two dark brown spines the setigerous process, whilst beneath is the dark brown crotchet. As the tail is approached the number of the pinnæ of the branchiæ diminishes until two and then a single filament is left, and this becomes shorter and shorter until only a thickening at the base of the cirrus remains, but it is interesting that they are continued almost to the tip, which has two short ovate cirri beneath the anus. It is worthy of note that where two

spines occur in the foot of Euniceids proper the upper is generally the stronger. This species has a somewhat extensive distribution from the American shores of the Atlantic (as a commensal of polyps) to the Mediterranean.

A fragmentary *Eunice* approaches *E. floridana* in many respects, but differs in so far as the typical foot carries a large branchia of four divisions, its massive base being more than twice that of the short dorsal cirrus and thus diverging from such as *E. norvegica*, to which it also is allied. The setigerous region forms a blunt cone supported by a black and a brown spine, whilst beneath is a slightly curved bifid crotchet. Superiorly and intermingled with the next series are large brush-shaped bristles, with a finely serrated edge and a lateral filament at each side. The long simple bristles have the tips slightly curved, enlarged, and then tapering to a fine point with a narrow wing on each side. The compound bristles have the shaft enlarged at the distal end, slightly curved back and pointed, with a few striæ internally. The winged terminal piece has a stout spur and a curved process beyond it, and in many the distal is the larger, thus diverging from *E. floridana*. The ventral cirrus is a stout conical process projecting even further outward than the small dorsal cirrus. Proceeding backward the filaments of the branchiæ diminish to three, then two, and finally to a single minute one, and disappear, whilst the dorsal cirrus in the terminal region becomes a little longer, the ventral cirrus smaller, as also are the bristles. It further is distinguished from *E. floridana* by having four caudal cirri (two smaller being in front of the subulate ones), and the posterior branchiæ also differ in character.

In comparatively few species of the genus *Eunice* (*Leodice*, Treadwell) do the branchiæ begin so far back as the 34th foot. Amongst those in which they arise considerably behind the head are *E. paupera*, Grube, from the Philippines, where they begin on the 23rd segment, and *E. siciliensis*, from the Mediterranean and the Philippines, in which they do not appear till the 84th segment. In *Leodice aculeata* of Treadwell they arise from the 14th to the 21st segment. They begin in the middle of the body in *E. hamata*, Schmarda, from Jamaica, on the 30th segment in *E. depressa*, Schmarda, from Auckland, New Zealand, and in *E. collini*, Augener, from the Antilles, Morocco, and Cape Verde, from the 10th to the 22nd segment. In most of these the branchiæ have few pinnæ.

Eunice cirrobranchiata, M'L., was procured in Cape waters in 20 fathoms, on mud. The cephalic region is bifid in front, but on the dorsal surface of each palpus is a rounded ridge which gave rise to Kinberg's four-lobed head. Tentacles rather long, the median reaching backward to the 5th foot, the adjoining pair shorter, the external still less. All are moniliform as if articulated. A considerable eye is situated behind the base of the external tentacle. The nuchal cirri are comparatively large and long, the tips projecting beyond the front edge of the buccal segment. The maxillæ are normal with a marked distal curve; the right great dental plate has seven teeth, the left six; the paired plates eleven; the unpaired is injured; the mandibles are so softened as to be unreliable. The body is about 5 inches long and 5-6 mm. in diameter in front, and is remarkably firm and tough. A minute branchial process appears on the 25th or 26th foot, and about the 70th it becomes bifid, but comparatively short, and continues so till near the tip of the tail where it again is simple. The organs throughout are comparatively small in comparison with the dorsal cirrus, and in some the range of the simple branchiæ at the tail is greater than in others. The anterior foot has dorsally the subulate crenulate cirrus of moderate length and which by-and-by has the single branchial process; then a tuft of slender tapering bristles without wings, amongst which are a few brush-shaped forms. This is followed by a group of compound bristles, the shafts with curved, flattened, and widened distal ends, usually serrated at the edge, and a short, bifid, and winged terminal piece, the arrangement of the two distal spurs being similar to those in *E. floridana*. As soon as the branchiæ are developed three strong spines, with slightly curved tips, project at the tuft of compound bristles. The ventral cirrus is short and slightly tapered. Posteriorly the foot has dorsally the cirrus and the bifid branchia, which is only about half the length of the cirrus, then the simple bristles and numerous and longer brush-shaped forms, and the three powerful dark brown spines, followed by the compound bristles and a dark brown crotchet. The ventral cirrus is somewhat lanceolate and longer. The tail ends in two long cirri beneath the vent. The comparatively small size of the branchiæ and the prominence of the brown spines externally are noteworthy features. This *Eunice* comes nearest to *E. cirrobranchiata**, from the Bermudas, a form approaching *Leodice denticulata* Webster, from the Dry Tortugas. The latter author's

* "Challenger" Report, XII. Annelida," p. 277.

L. culebra is likewise allied in the short simple condition of the branchiæ, but rarely are they bifid. In Treadwell's *L. crassi-tentaculata*, from Pago-Pago harbour, the gills begin on the 24th foot, become trifid, and posteriorly longer than the dorsal cirri.

Eunice, near *coccinea*, Grube?, was obtained at low tide, Torrér Point, Portuguese East Africa.

The head bears distinctly moniliform tentacles and nuchal cirri, which (latter) do not reach further than the middle of the buccal segment. The eyes are at the outer side of the base of the lateral tentacles. The dorsal cirri have a swollen base supported by a few spines and are articulated like the tentacles. The branchiæ commence on the 6th foot as a large process of 13 unilateral pinnæ and they continue to the 70th segment as prominent organs, the tip of the tail in the only example being in process of regeneration with two small subulate cirri beneath the arms. Crossland* states that the gills begin on the 6th foot in the African (Zanzibar) examples, whereas in those from the Maldives and Seychelles they begin on the 9th foot. The gills are large, but do not normally cover the back. The number of well-developed gills varies from 24 in small to 110 in large examples, and the maximum number of pinnæ ranges from 6 in small to 17 in large. His (Crossland's) figures of the compound bristles differ from the South African specimen.

Extensively distributed on the shores of the Atlantic and extending to the Philippines.

Eunice murrayi, M'I.—Found at a depth of 240 fathoms in Cape waters on mud. The tentacles in this form are long and all are articulated, especially at the tip. The nuchal cirri are slender, tapering, and longer than the antero-posterior diameter of the second segment; they are also slightly articulated. A rather large eye is present on each side at the base of the lateral tentacle. The basal plates of the maxillæ are short, and the blades themselves are moderately curved; the right great dental plate has eight teeth, the left nine; the paired plates have nine besides the accessory pieces and their teeth; the unpaired shows eleven teeth. The mandibles stretch out distally in a somewhat broad oblique edge. The branchiæ begin as a short simple process on the 4th foot and rapidly develop more pinnæ, so that at the 10th foot there are eight divisions, at the 18th ten, and they remain large for a space, but at the 36th foot

* Proc. Zool. Soc. 1904, p. 300.

are considerably diminished (about four pinnæ), and cease toward the 49th foot (posterior third of the annelid). The body is about 2 inches in length and terminates in two long tapering cirri, which show indications of articulations toward the tip. The dorsal cirrus is much diminished posteriorly, the setigerous region more conical, and the ventral cirrus is a short conical process. Two large spines, with sharp, slightly hooked tips, project beyond the upper bristles, whilst below are the compound bristles and a stout winged crotchet. Large ova occurred in the feet. This form resembles *Eunice fasciata*, Risso, though the teeth on the great dental plates, the paired and the unpaired plates are more numerous, and the branchiæ cease at the 49th foot. In a large example of *E. fasciata*, from Plymouth, in the British Museum the gills are very conspicuous in the dorso-lateral region, 10 to 13 pinnæ being present. Posteriorly they diminish as in the Cape form.

This species probably has an extensive distribution in the Atlantic and it may yet be united with European varieties.

Marphysa sanguinea, Montagu.—Dredged. One notable feature in the extensively distributed South African examples is the great development of the short broad forms of the brush-shaped bristles at the dorsal edge of the upper series, a group occurring at one edge of the tuft of simple dorsal bristles, and quite differ from the longer brush-shaped kind at the other edge of the tuft. They have a broad base, widen distally, and are split into coarse teeth. Willey's example came from St. James, False Bay. The branchiæ commenced on the 17th segment, and as simple filaments throughout seven segments.

Marphysa acicularum, Webster*.—Procured on Polana beach, Portuguese East Africa. A fragmentary specimen measuring about an inch in length. The cephalic region is deeply bilobed, the tentacles of average length and smooth. The rather small eye is on each side at the base of the lateral tentacle. The peristomial segment is about the breadth of the two following. The branchiæ commence as a single filament on the 30th foot, thus behind those of *M. sanguinea*, and rapidly increase in size and in the number of filaments—that is, four long slender divisions,—and these continue to the posterior end of the fragment. The foot has very slender, simple dorsal bristles, thin and flattened, with finely tapered

* Contrib. Nat. Hist. Bermuda, Bull. U.S. Nat. Mus. No. 25, p. 319, pl. x. figs. 50-53.

tips, and the compound bristles have long, delicately tapered extremities, which thus diverge from those of the common form. The foot also does not show the sulcus between the somewhat triangular ventral cirrus and the glandular pad internally, whilst the dorsal cirrus is longer and more finely tapered. The brush-shaped bristles had disappeared. This form approaches *M. simplex*, Treadwell*, but the bristles differ. Willey again describes another species, *M. adenensis-porcellana* (from the Cape), as having an emarginate prostomium and compound falcigerous bristles, the branchiæ agree in localization with those of *M. belli*, and therefore differ from those of the present species.

Nicidon cincta, Kinberg†, was dredged in 50 fathoms (No. 85) in Cape waters. The head presents a bilobed border, with the five rather short, smooth tentacles. A conspicuous black eye exists between the lateral and the external tentacles, and thus further outward than in *Eunice* proper. The segment bearing the short nuchal cirri is about half the breadth of that in front. The maxillæ are boldly curved, and have flattened basal plates; the great dental plates have three large teeth, the paired plates show a smooth horny edge, and the unpaired seem to be in the same condition—it may be, from injury. The body is typical, though the very numerous and very narrow segments, the black spines, and the absence of branchiæ are diagnostic. In the preparation the body tapers a little toward the snout and is nearly of uniform diameter till the caudal diminution occurs; moreover, these caudal segments are proportionally broader than in front. The anterior feet have dorsally a short subulate cirrus, the setigerous region has two or three black pointed spines, a dorsal tuft of bristles with straight shafts, and rather abruptly tapered to very fine translucent tips with a trace of a curve, but the tips are about equal in length and thus differ from those in *Eunice*. The long tips are flattened, without trace of the bellied condition figured by Treadwell‡ in *N. kinbergi*, yet the present form is nearly allied, differing chiefly in the absence of the hooked crotchets, and, if the coarse lines of his fig. 327 indicate serrations on the edge of the dilated end of the shaft, such diverge from the present species in addition to the points formerly noted. The wide distribution of Webster's form in the American area point to its being a common species. The compound

* No. 312. Carnegie Instit. Washington, p. 151, pl. v. figs. 8-12.

† Annul. Nova Overs. af. Kongl. Vet.-Akad. Forhandl. 1864, p. 564.

‡ Carnegie Instit. Washington, vol. xv. p. 92.

bristles beneath are flattened and translucent with a slight enlargement at the end of the shaft, the edges of which are minutely serrate; the thin flat terminal piece beyond is also minutely serrated on the edge, and tapers to a small bidentate tip which has characters of its own. The tips of the dark brown spines are simply pointed. The ventral cirrus forms a small, bluntly conical lobe not half the length of the short dorsal cirrus. None of the large crotchets appear to be present. In the posterior feet is a single dark brown spine and the feet are much diminished, whilst the dorsal and ventral cirri are proportionally longer and more slender. The dorsal bristles are attenuate and the tips curved, whilst the compound forms have a backward bend of the shaft and the enlarged distal region is striated. The very minute bidentate tip remains.

A remarkable feature about this ebranchiate Eunicid is the presence of a translucent living organism, which coated the entire animal and was difficult to remove. Two kinds of spicules are prominent in it, viz., a stout, slightly curved kind with a rounded end and a sharp point, and a multitude of long, straight, glassy needles of great tenuity interwoven with the investing tissue in every direction. Prof. Dendy kindly examined the investment and he was of opinion that the cellular tissue did not pertain to a sponge. In his account of *N. kinbergi*, Prof. Treadwell mentions that he found some examples in sponges in the Tortugas. Other Polychæts, again, are commensals with corals, the slender (horny) fibres of which form living tubes surrounding them.

The genus *Nicidon* was established by that careful worker, Kinberg, for those Eunicidæ with a bilobed snout, seven "maxillæ," and nuchal cirri, but devoid of gills. His representatives came entirely from the Pacific. They seem to occur rarely in collections. There are few distinctive features in Kinberg's account of the three species, *N. longicirrata*, *N. cincta*, and *N. gallapagensis*. As Grube observes, two are very probably examples of *Eunice siciliensis*, only the third, *N. cincta*, being a true representative, and Crossland* is of the same opinion. The Cape specimen is incomplete posteriorly, but it had about 180 bristled segments, all narrow, and showed no indication of the broader segments noted by Crossland in his *N. gracilis*, a species closely allied, as also is the *N. brevis*, Ehlers†, from Key West.

* Proc. Zool. Soc. 1906, vol. i. p. 326.

† American Annel. p. 38, Pl. 28 & 29.

Family Onuphididæ.

Diopatra neapolitana, Claparède, var., occurred on Bird Island Fishing Ground. The bilobed cephalic region has long, gently tapered tentacles, the median longer than the others, and with glistening ringed cirrophores; all follow the arrangement in *Eunice*. A pair of short subulate palpi arise in front below the tentacles. The subulate nuchal cirri stretch from the edge of the first segment nearly to the end of the cirrophores of the median tentacles. An eye occurs on each side of the prostomium in front of these. The maxillæ are less developed than in *Eunice*, being more attenuate anteriorly, curved, and sharp-pointed. The basal plates are triangular; the right great dental plate has 10 and the left 13 teeth; the paired plates have about 8 teeth and are less curved than in *Eunice*. No unpaired plate was present. The mandibles are small with bevelled edges. The body is about 7 inches in length, and about 6 mm. in diameter in front, where it is rounded. It is flattened posteriorly. The ventral surface has a broad median groove—here and there with raised edges. Diminishing posteriorly, it ends in a dorsal anus, beneath which is a short pedicle with 4 minute cirri, which stand stiffly out like a rosette. The cœlom is crowded with small ova. The branchiæ commence on the 5th foot with large main axes tapered from base to tip and short pinnæ somewhat spirally arranged. They continue on each foot half the length of the body (62 pairs), becoming somewhat less posteriorly and then cease. The long dorsal cirri go to the posterior end. The first part has its setigerous process large and pointed, the curved and rather strong bristles having a bifid tip, the distal point being blunt and rounded, the secondary process close to it and conical, whilst two thin wings form guards at the extremity. A short distance below is a peculiar differentiation not present in *Onuphis* or *Hyalinæcia*. Such may be a provision connected with wear or injury and is a noteworthy feature. Claparède makes two varieties of this species, the typical form of Delle Chiaje according to him presenting no bifid tips to these bristles, whilst the variety *ferruginosa* has bifid tips and pointed wings. The blunt tips and the position of the wings in the former would suggest that such is due to the position of the bristle under examination. Both kinds show the differentiation which he (Claparède) attributes to an imperfect compound condition. The figure of these, given by Baron de St. Joseph*, again, is very imperfect.

* Ann. Sc. Nat. 8^e sér. t. v. pl. xiv. fig. 35.

Both the account and figures are in need of improvement, though he locates the several kinds correctly. The dorsal and ventral cirri of the first foot are well developed. The second foot is similar, with a long, curved, bifid bristle, the hood tapering to a fine point. The third foot has more of these bristles, and the fourth, whilst similar in its soft parts, has a much larger series with the pointed hood, and the terminal piece is more distinctly outlined. As De St. Joseph points out, these bristles disappear at the first branchia. In the typical anterior foot the diameter of the branchia at its base considerably exceeds that of the dorsal cirrus, which is supported by a long bundle of small spines. The truncated setigerous lobe has 4 or 5 spines of nearly equal size, and at its edge a semicircular flap, the ventral forming a flattened lobe separated by a notch from a smaller fillet internally. The upper tuft of bristles is composed of comparatively short, rather stout, finely tapered simple forms with narrow wings, Claparède figuring these as minutely spinous. Then follow long, slender, brush-shaped bristles which have fully 25 fine teeth and a longer filament at each side, their dilated tips extending even beyond those of the next (inferior) series consisting of longer and more slender simple bristles than the upper set of the same kind, the tips being slightly flattened before tapering to a fine point. These are accompanied by a few brush-shaped forms. The brush-shaped bristles occur from the 6th foot to the tail. With the cessation of the branchiæ in the posterior feet the simple bristles become much longer, the distal curve marked, the wings narrowed, whilst beneath are two powerful crotchets with the processes at the bifid, winged, end remarkably distinct, the wings being sometimes absent*. The brush-shaped bristles seem to have a character of their own.

Each foot posteriorly, indeed, is very distinctly marked, and the long bristles project conspicuously. The tube inhabited by the annelid is long and tough, the exterior being more or less coated with sandy mud. The great length of the axis of the branchia and the short whorled pinnæ are characteristic.

Diopatra chilensis, De Quatrefages, as described by Ehlers †, has gills of similar structure, both as regards the stout tapering axis and the spiral arrangement of the short pinnæ. The grouping of the large branchiæ to a limited region in

* De St. Joseph's figure shows too great an enlargement of the upper end of the shaft; and Claparède figures one without a wing.

† Polych. Magell. u. Chilen. Strandes, p. 123, pl. xv. figs. 1-12.

front, however, differs from the arrangement in the Cape form, yet the variations in each are more or less unknown. In an example of *D. amboinensis*, Aud. & Ed., in the British Museum, the gills resemble those of the Cape species.

So far as can be observed, the Cape *Diopatra* is a variety of *D. neapolitana*, of Delle Chiaje, in which the gills are more tapered from base to apex and the filaments shorter than in those from Naples. In the latter form (Brit. Mus.) the branchiæ arise on the 4th foot, and each forms a bushy series of pinnæ all round and is less tapered at the tip. The number of gills appears to be about the same in both. The tube is cylindrical, greyish, 3 inches long, and composed of tough secretion with a thin coating of mud.

Diopatra, near *viridis*, Kinberg, was got in the shrimp-trawl, 11 miles east of Baboon Point, and dredged at 50 fathoms off the Cape on mud. The cephalic region is without distinct eyes, though a pigment-spot exists behind the base of the median tentacle, which, in the specimen, is shorter than the lateral. The external tentacle, from the limited area of the head, is more or less in front of the lateral. All these organs are of considerable length and crenulate. The nuchal tentacles extend to the terminal third of the cirrophores in front. The body has about 115 segments and terminates posteriorly in two short cirri. Anteriorly each segment has a pale anterior border, then a band of brown, but before the branchiæ terminate the general pallor of the posterior region commences. The branchiæ begin on the 5th foot, are proportionally more bushy than in the former, and extend to the 49th foot, diminishing before ceasing. The pinnæ at the distal end of each form a terminal tuft—somewhat truncated,—and the pinnæ throughout are finer than in the former *Diopatra*. The first on the right is less than the 2nd, but that on the left is as large as its successor. Diminishing to a short series of a few pinnæ posteriorly, the following foot may have two processes, the next one slender and short pinna, and then they cease. As stated, the pinnæ throughout are more slender than in *D. neapolitana*, and the axis considerably less (but the smaller size of the annelid has to be remembered), yet the character of the branchiæ in each essentially differs.

The first foot has the bifid winged bristles with exactly the same distal and secondary processes as in the previous form, and a short distance below the same differentiation, whilst the long wings are similarly pointed. In the branchial region the foot anteriorly has the large branchial stem, with

the subulate dorsal cirrus beneath; the diameter of the base exceeding that of the rest of the foot, which is little developed and is truncated distally, the short and somewhat conical ventral cirrus bounding it inferiorly. The superior bristles are slender and tapering, and are accompanied by brush-shaped ones; the inferior consisting of stronger forms with tapering, curved, and apparently winged tips. Spines support the dorsal cirrus. Posteriorly the dorsal cirri become longer, and the brush-shaped bristles are very conspicuous as they extend beyond the simple forms. Beneath are a few of the stouter bristles with the curved tips, and below two powerful crotchets similar to those of *E. neapolitana*. The tube is composed of tough secretion covered with fine blackish mud.

This form comes near Kinberg's *D. viridis*, from the region of the Atlantic beyond the estuary of the La Plata, on a bottom of stones and mud. At first sight the thinly distributed branchial pinnæ recalled those of *D. leuckharti*, Kinberg, from Oahu, but they are fewer and less filamentous, and anteriorly they have smooth bases. On the whole, however, there is really no feature of moment to distinguish this from the foregoing. The branchiæ alone diverge, and it is doubtful how far these organs vary in the same species.

A fragment of a small *Diopatra* near *D. dentata*, Kbg., an inch and a half long (probably a young form), was dredged in 210 fathoms on sandy mud (No. 49). The head is typical with ringed cirrophores, and there are no visible eyes. The jaw-apparatus was injured, but, so far as could be seen, the basal processes of the maxillæ are short and the great dental plates have 6-7 teeth. The dorsal surface of the body has a reddish band in each segment, and the tail terminates in two long slender cirri. The branchiæ begin on the 5th foot, and form a small arbuscle after the type of the preceding, the total number of pinnæ being about 19, and the axis thicker at its base than the dorsal cirrus, which, however, is only a little shorter than the distal tips of the branchial pinnæ. Spines pass to the base of the cirrus. The branchiæ continue throughout half the length of the body and then cease, whilst the dorsal cirrus becomes a slender filament posteriorly. The foot offers little distinction, except that the ventral cirrus is pointed with a rounded glandular fillet at its inner base. Bifid crotchets of the typical form occur posteriorly. The foot, on the whole, appears to agree in structure with the foregoing.

A *Diopatra* collected between tide-marks at Port Mahon, Portuguese East Africa, has its anterior end in process of reproduction *, the region presenting the form of a dark brown cylinder attached to the normal segment behind it. At the anterior end are two tentacles belonging to the right side with dark brown cirrophores, the truncated cirrophore of another being on the left, four feet are indicated on each side. Posteriorly the tail has two long slender cirri. The branchiæ commence behind the reproduced part, 6 or 7 being remarkable for the large size of the smooth main stem, its stiffness and the shortness of the pinnæ, and in this respect it has certain resemblances to *D. brasiliensis*, Kinberg. Instead of the pinnæ collapsing on the main stem when removed from the annelid they project rigidly, yet the shape leans to those of *D. neapolitana*. An injured organ showed a rosette of short pinnæ at the tip—probably an effort at functional efficiency. The feet are prominent—it may be owing to the absence of a tube in preservation, yet the iridescent rigid body shows that such is a characteristic. Anteriorly, the smooth dorsal cirri (to which a few spines go) are subulate organs of considerable length, much tapered distally and carrying the branchiæ. The setigerous lobe is truncated, and has the two groups of rather stout, finely tapered bristles, the upper with narrow wings. The ventral cirrus is long and acutely pointed with a glandular pad at its base. A simple gill-filament only occurs at the end of the branchial region, and then the foot bears the slender dorsal cirrus, a small setigerous region, and the long ventral cirrus. The cirri are very slender posteriorly and attract less notice than the long stiff bristles of the caudal region. The crotchets are included in the tissues. Posteriorly the long, finely tapered bristles show no evident wing, and no brush-shaped forms were seen. Two powerful crotchets are present ventrally, the inferior being stout and with a peculiar incurvation below the bifid winged tip, and a third is developing in the tissues. The foot is shortened and the tapering process is reduced. No tube accompanies the specimen.

As in the Eunicids proper it would appear that much has yet to be done in regard to the specific distinctions of the genus *Diopatra*, some species approaching the Mediterranean form in structure. Thus *D. splendidissima*, Kinberg, from Guayaquil, though apparently different, has gills with a stout axis, but more numerous pinnæ than in *D. neapolitana*, and

* *Onuphis gracilis*, Ehlers, appears also to have a reproduced anterior region (Florida Annel. p. 7c, pl. xxi. fig. 5).

the tip of the organ is less tapered and is spirally twisted. *D. longicornis*, Grube, from the Philippines, has also spirally arranged and rather short pinnæ on the axis, and they are more numerous than in the South African form, though the organ as a whole tapers distally. The long tentacles are smooth, whilst the first 4 feet are modified to turn in ventrally.

In surveying the different forms of *Diopatra* in the South African collection it is seen that the gills vary considerably in outline, some having these very long and, with their pinnæ, assuming a conical shape, others being broad distally; but the specimens also differ in size and probably in age. Little distinction can be drawn from the bristles and crotchets, or in regard to the brush-shaped forms, nor does the tube afford more that is characteristic. The tube of the larger form is nearly a foot long—composed of secretion here and there stiffened with sandy mud, the other parts being flexible. Those from Nos. 81 and 112 have stiffish straight tubes of secretion thickly coated with mud. Again, there is little in external appearance to form a basis for separation, except in size. In contrasting the gills of the several forms, it is apparent that those of *D. neapolitana* have a larger and longer main stem or axis, whilst the pinnæ on it are proportionally shorter, the whole tapering distally to form a sharp cone. In *D. viridis*, on the other hand, the pinnæ are more slender and form distally a bushy tuft. In *Diopatra* (near *dentata*), from No. 49*, the gills lean to the shape of *D. neapolitana*, in so far as the pinnæ become shorter toward the tip, and the annelid is much smaller (if not young), whilst the whole gill remains rigid after removal. In *Diopatra* from No. 4 (Port Mahon) the shape of the gills leans to that of the second form.

The variations undergone by such forms are more or less unknown, and it may be that the relationships of the four forms are closer than at present imagined.

Hyalinæcia tubicola, O. F. Müller, occurred at several stations (47, 48, 50) in Cape waters. The examples are large, and the tubes are likewise much larger than those of the European representatives, yet they are considerably less than the gigantic tubes from the coast of South America†. This species ranges over the North Sea and the shores of Norway, southward to the Mediterranean, is not uncommon in the Atlantic south of the Cape of Good Hope, and westward

* Port Mahon.

† Annel. 'Challenger,' p. 336.

to American shores as well as to New Zealand. The structure of the bristles, the distribution of the simple branchiæ, and other points are very constant under these diverse conditions. Moreover, it is clear that the waters of the Cape and those of Brazil are famous for the size which this form attains. It is noteworthy that all the Cape specimens (in this collection) occurred at 312 fathoms on sand.

Onuphis quadricuspis, Sars, was dredged in 47 fathoms off the Cape, in tubes of secretion coated externally with sandy mud, tapered at one end and with a flap of secretion. They protrude from either end. The first foot shows bristles with the bifid tip and the differentiation below as in *Diopatra*, but the bristles are stronger, and the two wings at the tip end bluntly in some, thus differing from the British examples, in which the wings end in tapering extremities; but this may be due to wear, as others have pointed tips. A minute 3rd spur occurs below the secondary process. One was laden with large ova. It is interesting to find this northern type at the Cape. It frequents great depths in the seas adjoining Britain, as shown in the expedition of the 'Porcupine' and 'Knight Errant,' and extends to Norway and Canada.

Family Glyceridæ.

Glyceria alba, H. Rathke, was procured both at the Cape and Portuguese East Africa. The branchiæ become prominent about the 24th foot, and, in a few, toward the posterior fourth of the body; they are bifid, then they become single and small, disappearing from the last 12 or 15 feet. The slender snout with its four minute tentacles has about fourteen sulci.

Glyceria goesi, Malmgren, was dredged in 123 fathoms off the Cape in mud. A fragmentary example in which few of the gills remain, but all arise from the anterior border of the foot, which has a little brown pigment at the tips of the lobes. The species is not uncommon in the northern seas, along the eastern shores of the Atlantic, and from the Mediterranean to Japan in fairly deep water. Fauvel unites it with *G. rouzii*, Aud. & Ed.

Three species of *Glyceria* thus frequent the waters of the Cape, for *G. siphonostoma*, Delle Chiaje, was obtained by the 'Challenger' at Station 142, lat. 35° 4' S., long. 18° 37' E., in 150 fathoms on a sandy bottom, and it is also included in Prof. Willey's* littoral species from the mud of the lagoon at

* Trans. Linn. Soc., Zool. vol. ix. p. 260.

the mouth of the Knysna river and (2) from the muddy ground at Table Bay. Fauvel considers that *Glycera gigantea*, De Quatrefages, is synonymous with this species, which stretches from the Mediterranean to the Channel and the Atlantic.

Family Opheliidæ.

Ammotrypane aulogaster, H. Rathke, was dredged off the Cape in 470 fathoms on sand and shells, and in 123 fathoms in mud. This form extends from the Arctic seas to Britain and the Atlantic.

Family Chloræmidæ.

A fragment of the middle of a small Chloræmid resembling *Stylarioides glauca*, Malmgren, is in the collection, though no locality is given.

Family Chætopteridæ.

Chætopterus variopedatus, Renier (a dried tube), comes from the neighbourhood of Chefina Light in 8 fathoms on sand. The species is not uncommon at the Cape, and ranges from the northern seas to the Mediterranean, the Atlantic, Red Sea, and the Straits of Magellan.

Phyllochætopterus socialis, Claparède, was dredged in 123 fathoms on mud off the Cape (No. 40). The head has a buccal funnel. No eyes are visible in the injured and softened example. A transverse ridge crosses the dorsum opposite the 2nd feet and carries two short subulate tentacles. The anterior region has nine bristled segments, the first feet being elongated and directed inward and backward on the dorsum. The bristles of this region have a similar arrangement and structure to those of *Chætopterus variopedatus*, though specifically different. They commence superiorly with long spear-shaped forms, having symmetrical wings and tapered tips, the wings gradually become broader, the tips shorter, then toward the ventral border the widened tip is asymmetrical like a deep-bellied knife, and, lastly, some end in slightly curved and narrow tips like a curved and pointed scalpel. The fourth foot bears the powerful tooth-like bristle with an oblique tip and a high process of the crown, accompanied by a group of slender spear-tipped bristles. Posteriorly the translucent and minute hooks have the finely serrated and slightly convex anterior border and the concave outline posteriorly as shown in plate cxxxvi. fig. 12a*.

Roule joins *P. fallax* with *P. socialis*, but Fauvel considers them different on account of the greater number of segments in the anterior region—a character, however, which is variable. The occurrence of small spear-shaped bristles with the large tooth-like form in the 4th bristled segment in *P. fallax* is a more reliable feature. The specimen of *P. socialis* in the British Museum is small, resembling a *Spio*, but has nine bristled segments anteriorly and about five in the middle region. No small bristles appear along with the large “tooth” of the 4th foot.

Family Spionidæ.

Nerine capensis, sp. n., was procured at Maizenberg. In the form of the head it agrees with *N. cirratulus*. The body is about 2 inches long, slender and tapering posteriorly, ending in a smooth button-shaped process, which thus differs from the crenate anus (semicircular bilobed membranous process, *Claparède and Lo Bianco*) found in *N. cirratulus*. This sucker-like or button-shaped process is not an extruded anal region. The size of the specimen considerably exceeds that of *N. cirratulus* in the British Museum. The branchiæ, as in *N. cirratulus*, arise on the 2nd foot, and are shorter than the following pair. Anteriorly, each foot has its branchia furnished with a web of tissue which bulges inferiorly, narrows a little in its progress distally, and forms a separate tip, the diminished branchia passing independently beyond it. These feet (anterior) show a ventral web inferiorly in front of the stout, short, tapering, simple bristles, then a gap occurs, followed by the projecting web at the base of the branchia and the curved tapering dorsal bristles, also of considerable strength, and forming a comb-like row. Proceeding backward, the branchia gradually separates itself to a large extent from the lamella till it (branchia) ceases about the 50th foot, and therein it differs from *N. cirratulus*. The gills continue to the tip of the tail, the foot presenting dorsally a hatchet-like web of cuticle and hypoderm with the few long slender bristles, whilst the inferior web is curved upward as a bluntly conical lamella, beneath which is a row of about nine long winged hooks. The branchiæ are filiform and pass from the inner edge of the dorsal web, so that, viewed from above, the dorsum has a characteristic aspect.

Polydora armata, Langerhans, was procured by the large dredge at 47 fathoms in a shell at No. 113 in Cape waters.

The cephalic region agrees with the ordinary form. Like *P. ciliata*, a small tuft of bristles occurs in the ventral division of the first foot, the three following having both dorsal and ventral tufts, the former the longer, and most show traces of wings, whilst the curve at the tip of the ventral tuft is marked. The fifth foot, besides the great crotchets, has a dorsal and a ventral tuft of simple bristles—shorter than the rest. On each side are two feebly developed crotchets and the tip of a third developing in the tissues. Each has a stout shaft enlarged in the middle, narrowing at the neck, with a stout sharp hook at the tip, and behind it a bilobed crown. The succeeding foot has the long tapering bristles, and ventrally a shorter series also with curved tips, but no hooked tip was present. The next foot, however, has the usual dorsal bristles and a set of long winged hooks ventrally, thus corresponding with the condition in *P. ciliata*. The same arrangement continues to the posterior end, only the dorsal bristles are longer and project prominently. Moreover, the last six (eight, *Langerhans*) segments present a remarkable structure—since on the dorsum of each a pair of tufts of large spear-shaped bristles occurs, and which can be spread out to form a formidable rotate series of spikes. Three or four of these are large, the terminal two are small. Each bristle is slightly narrowed at the base, widens out, and then tapers to a sharp point, and the outline is double as if the central region differed from the harder investment. In addition to these each segment has its ordinary dorsal bristles and ventral hooks. The reason of this striking armature of the posterior end of the annelid can only be explained by a careful study of its habits in life. Some might suppose these hard spines assist in making the tunnel in the shell (yet others bore without them), whilst others would attribute the protection of the tail to them. The caudal cup has the usual break in its outline. The shell in which it bores to the depth of $\frac{1}{4}$ of an inch or more is a heavy and hard one. This species was discovered by Langerhaus * at Madeira, then was found by Lo Bianco † and Carazzi ‡ in the Mediterranean perforating shells of *Venus*, and again by Mesnil § on the shores of France. It now extends to the Cape.

* Zeitsch. f. w. Zool. 1880, p. 93, Taf. iv. fig. 5.

† Atti Acad. Sc. Napoli, vol. vi. ser. 2, no. 11, p. 28.

‡ Mitt. Zool. St. Neapel. 1893.

§ Bull. Sc. Fr. et Belg. t. 29, pl. xiii. figs. 13-25.

Family Cirratulidæ.

A single small example of *Cirratulus tentaculatus*, Montagu*, occurred at 270 fathoms (No. 50) in Cape waters. Like *C. cirratus*, it seems to be almost cosmopolitan.

Family Halelminthidæ.

Dasybranchus caducus, Grube, from St. James.—A cosmopolitan species, which appears to be common in the seas of the Cape. It ranges throughout the Atlantic, the Indian, and the Pacific Oceans. Eising's figure† of the hook has the wing rather short and broad, for it extends considerably further down the shaft, as shown in the Monograph‡.

Notomastus latericeus, Sars.—Dredged at the great depth of 1010 fathoms in *Globigerina* ooze (Station 534) along with *Makellicephala*, *Leanira*, and *Hemilepidia erythrotænia*. The anterior region alone was in a good condition, the rest being pulpy. This is another cosmopolitan species, stretching almost from pole to pole, and generally in the Atlantic from shore to shore.

Family Maldanidæ.

Maldane sarsi, Malmgren, was dredged at various stations (37, 175, 177), at depths ranging from 25 to 417 fathoms and "from the tail of a shark at the mouth of Tugela river." A large example from Algoa Bay has the cephalic fillets shorter, and the fold or collar broader posteriorly, as well as slightly crenate at the edge, and it makes a sharp angle with the middle line. In the hooks the spikes above the crown are somewhat flatter—it may be from age. This widely distributed and chiefly northern form extends from the seas of northern Europe to those of Greenland, and to the Atlantic and Pacific Oceans. It abounds on the shores of Canada, and at the Cape was accompanied at Station 177 by *Leanira*. The specimens were rather small, and all seemed to inhabit tubes of dark grey mud and secretion. The specimen obtained on the tail of the shark had probably adhered on striking the bottom.

Praxilla prætermisssa, Malmgren. — A fragment of the middle region off the Cape at 1180 fathoms. It was not uncommon in the previous collection.

* Formerly mentioned in the 'Marine Investig. So. Africa,' vol. iii. p. 68.

† Flora and Fauna Nap. xvi. (1887).

‡ Ray Soc. 1915, plate cvii. fig. 15 a.

Family Ammocharidæ.

Owenia fusiformis, Delle Chiaje.—Dredged both off Portuguese East Africa (Inhaca) and off the Cape in 85 fathoms. The tubes are composed of black and white grains of coarse sand, Foraminifera, and rarely a spine of an Echinoderm. The number of translucent grains of quartz is characteristic. They are wider anteriorly and taper to a long slender posterior region. The nature of the tube does not permit the imbricated arrangement so generally seen in the British examples. The specimen from Inhaca is incomplete anteriorly, and the tube is of white sand-grains, which form a thick and neatly arranged wall lined by the secretion. The species appears to be cosmopolitan.

Family Hermellidæ.

Tetreres murata, Allen, var. *gilchristi*.—Dredged in 260 fathoms on mud. The crown is provided with a double row of long, sharp, spine-like paleæ of a pale golden colour. Two golden hooks occur dorsally. Fourteen papillæ occur on one side and sixteen on the other on the pillars. The paleæ, both outer and inner, are longer than in the British form, and their shape also differs in certain other respects, though in both the slender forms are posterior. The external paleæ are thin flattened blades, with a slight bend towards the tip, which ends in a blunt point, the blades being gently tapered from the middle. They thus differ from the tapered outer paleæ in *T. murata*, and somewhat approach those of the inner row. The inner row of paleæ is also longer than in *T. murata*, though somewhat shorter than the outer. Each widens from the base to the middle, then in the larger forms slightly diminish to the very thin tip, which is rather abruptly tapered to an acute point. Some of the shorter slightly increase in breadth toward the tip, then slope to the sharp point. They thus vary from the condition in *T. murata*. The latter shows 14 and 21 larger papillæ behind the crown, and the paleæ are much shorter, especially those at the tip of the pillars. The body is incomplete, only about thirteen segments being present behind the four thoracic (parathoracic, *Caullery*), the whole measuring barely an inch, whilst the diameter in the thoracic region is about 3 mm. The specimen seems to be mature, as ova are present. The thoracic bristles agree with those of *T. murata*, the first ventral being slender and simple, those following are small and spatulate, the dorsal being large and spatulate.

The posterior bristles are very fine and apparently have spinose tips. The hooks have eight teeth as in *T. murata*. The tube is blackish with white grains (Foraminifera) and has a short branch. In considering this form as a variety of *T. murata*, Allen, the differences between the two have not been overlooked. Thus the South African example is much smaller, the long split crown differs proportionally, and the paleæ so far diverge in minute details. The bristles of the first ventral tuft are minutely spinous in the British form, whilst in that form from the Cape their minuteness renders such invisible. The 4th series again show more distinct spines at the sides in the British form. The dorsal bristles posteriorly are of two kinds, long and rather strong forms with very fine spikes only at the tip, and others shorter, boldly spinous, probably whorled.

It is possible that the species of *Tetreres* have been unnecessarily multiplied and too little of a margin allowed for variation.

Sabellaria spinulosa, R. Leuckart, var. *gilchristi*, was procured in Portuguese East Africa (shore collection) at Port Mahon; at low tide on Polana beach; and at low water on the N.W. side of Inhaca. The crown forms a beautiful object under a lens, the golden paleæ being arranged densely and evenly on each side. The outer have a shape like that of *S. spinulosa*, but the tip has only a stout simple claw-like central process hooked at the tip with a less developed hooked spike next it and a smaller external one, thus differing from the European form. The tips are curved and also bent at an angle to the ray. The second row of paleæ has somewhat broadly lanceolate tips with an acute point, the whole bent at an angle to the ray, and lying more or less horizontally in the crown. In the third series the straight spine-like tips are also bent at an angle to the ray and slope upward and inward. The three series resemble burnished gold and form a striking array in the crown. The papillæ surrounding the base of the crown are long and more tapered than in the British form (*S. spinulosa*), though less pointed than those of Kröyer's *H. sanctæ crucis*, a variety of the common form, or in *H. exaltatus*, Marenzeller, from the Gambier Islands (Polynesia). The madder-brown pigment appears to be absent from the mouth-region, but the soft folds behind the mouth are present. The body is similar to that of the common species, viz., somewhat flattened, with a dorsal and a ventral groove, and terminating posteriorly in the short, cylindrical, smooth tail with a

bulbous tip. A series of olive-brown specks is external to the bases of the bristles throughout the greater part of the second region of the body, and these are composed of minute coloured granules under the microscope. Posteriorly the body seems to be flatter than in the British form. In shape and distribution the branchiæ agree with the latter, as also do the bristles. The anterior hooks have six teeth and the smaller posterior five. It is noteworthy that the changes in the paleæ have been followed by so few differences in the bristles and hooks. A hard tube composed of rounded grains of quartz accompanied the specimen from No. 25, but the bore seems to be too large for it. Externally it is nodular, but smooth internally. Light is transmitted through it.

The variations undergone by the Sabellarians possessing three rows of paleæ are interesting, such as *S. fissidens*, Ehlers*, from Chili, and *S. fauveli*, Gravier†, from Peru. If the plastic nature of these organs is considered it may be that further study may reduce the number of species.

S. spinulosa has a wide distribution in the northern seas, and its variations probably occur in the Atlantic as far as the Cape.

Family Terebellidæ.

Thelepus cincinnatus, O. Fabricius, was dredged both in Portuguese East Africa and in the waters of the Cape, at depths varying from 8 to 36 fathoms, chiefly on sand. In the structure of the cephalic region, the body, and the bristles, the specimens are typical. The hooks also closely correspond, having, in lateral view, a single spike above the main fang. There is, perhaps, a slightly increased depth of the base below the stud, but the ventral and the dorsal curves are the same.

A feature of great interest is the presence on each side of a softened mature example procured on June 28th of a large aperture having the shape of a narrow ellipse, with pouting smooth margins, situated above the edge of the ventral scutes, and between the lateral glandular belts pertaining to the 6th and 7th setigerous processes. As viewed from the ventral surface, the aperture is opposite the angle between two scutes. The specimen is fully ripe, and the large yellowish ova, about $\frac{1}{2}$ of an mm. in size, are in great abundance in the cœlom. It thus appears, if

* Polych. Magell. u. Chil. p. 196.

† Arch. Zool. Expér. 4^e sér. t. x. p. 650.

such is a typical arrangement, that in this group no rupture of the body-wall occurs, but that these larger pouting and finished apertures afford exit to the ova or other elements. Although the example is pulpy, the body-cavity showed two long nephridial sacs on each side, their diaphanous walls terminating posteriorly in inclosed and rounded ends, the tube being considerably narrower there. Both tubes clearly passed in front of the tumid slits, which appeared to be closed internally by a diaphanous membrane. The thick lips of the slit are probably muscular.

The range of *T. cincinnatus* and its varieties is extensive, viz., from the Mediterranean to Spitzbergen, Greenland and the White Sea, Iceland, Jan Mayen, Canada, the United States, and Japan, as well as various places in the Atlantic, Gulf of Mexico, Behrings Sea, and the South Antarctic Seas.

Polymnia capensis, sp. n., was dredged off the Cape in 420 fathoms on mud. In the cephalic region the collar is slightly developed and the grooved tentacles numerous. The mouth has in front a semicircular lamina which projects like a second collar, high dorsally and sloping to the shorter ventral edges, which approach each other in the median line, a gap in the preparation remaining between them. The lower lip is short, but behind it on each side is a leaf-like lamella joined to its neighbour by a narrow belt. Traces of many minute eyes occur behind the collar. The body is about an inch and a half in length, and thus comparatively small for a Terebellid. It is smoothly rounded dorsally and flattened ventrally, thickest in front and tapering toward the posterior end, at which is a comparatively large anus surrounded by about eight blunt papillæ. A notable feature is the extension of the ventral scutes throughout the entire length, and they are broad and rugose in front, but shrink into minute areas as the tip of the tail is reached. The branchiæ are three in number, the first on a stout stem, which breaks up into terminal branches with very short filaments, which under a lens resemble a bunch of papillæ. The second is much shorter—its trunk, indeed, is not a third as thick as the first, and its terminal twigs and filaments few. The third is developed into a minute and slender stem and a small terminal tuft. Seventeen pairs of bristles occur in the anterior region, the first being under the third branchia. They are stoutish simple bristles with slightly curved, tapered tips and very narrow wings. As in *P. nesidensis*, they form two groups, a longer and a shorter, and are finely

iridescent. The hooks in general outline approach those of *P. nesidensis*, but show in lateral view three teeth above the main fang. Minute comparison with the British species detects only a somewhat larger base as a whole. The tube is one of the most striking in the whole range of Polychæts, since it is in the shape of a U in the midst of what at first sight resembles branches of a zoophyte. But the whole is the work of the annelid which has coated the tough yet translucent tube with a vast multitude of Foraminifera of diverse shapes and sizes, and has attached at intervals accessory processes, apparently the stems of zoophytes, which divide and subdivide, and are all coated with the same translucent secretion as well as studded with the tests of Foraminifera. Only here and there can the tips of the imbedded zoophytes be recognized. Some of the stems coated with the secretion are fixed to the sides of the tube, and others stand out from it as independent stems with trifid tips formed solely of the secretion and a coating of Foraminifera. No branch of the zoophyte was in their interior. The appendages here and there interlaced with each other, and in one or two the connecting-link was a large sponge-spicule glued at each end by the secretion. Moreover, from a stem a long flag-like process of the secretion projected, thus completing the complexity of the environment. These branched and interlaced appendages were especially prominent at the oral end of the tube, where they formed a protective series. Some of the processes on the tube were short and tube-like, others formed leaf-like flaps which resembled pieces of *Ulva* or other seaweed flaunting from a rounded stem of the milky (-coloured) secretion. The open posterior end of the tube had several long flaps of the secretion, one coated on both sides with Foraminifera. The whole was a wonderful example of ingenuity and mimicry.

Terebellid Tubes procured in Cape waters at 448 fathoms on sandy mud. The anterior ends alone of seven tubes were secured, all being composed of secretion and black grains of sand, and more or less flexible. The pale secretion gave them a mottled appearance. Each aperture had nine or ten nearly straight filaments of the same nature as the tube and slightly tapered distally, each being about an inch in length. It is curious that the number of these filaments remained nearly the same in all examples, a contrast with the variable series in such as *Lanice conchilega*. In all probability the anterior ends of the tubes, which ranged from $\frac{1}{4}$ to 2 inches, had been projecting from the surface of the sand and were

swept off by the dredge, whilst the inhabitants slid further into the tubes for safety. A tube apparently identical was dredged by the 'Porcupine' (1869) off Valentia. It also had eight or nine radii.

Pista cristata, O. F. Müller, var. *capensis*, was found at low water on the north-west side of Inhaca, in Portuguese East Africa. The cephalic collar and other parts about the mouth corresponded with those of the European form. A band of minute eyes was visible in front of the first ventral shield. Instead of two nearly equal branchiæ, a large right organ of the typical structure is present, and a little behind its base is a small one with terminal tufts. The body is rounded and elongated, slightly flattened on the ventral surface, and marked in the median line by the nerve-cords. There are 16 ventral shields. An injury seems to have occurred so as to render the posterior shields indistinct, and also to render the usual circle of papillæ at the anus indistinct. Seventeen pairs of winged bristles of the typical structure occur in front; the hooks resemble those of the European species, but differ in having only a single tooth above the main fang, whereas there are three or four in the European. The tube is composed of fragments of bivalves and entire univalves neatly cemented together, yet appearing on the comparatively smooth inner surface. In this respect it differs from such tubes as those of *Lanice conchilega*. The species of *Pista* have a wide distribution in both Atlantic and Pacific Oceans. One good lateral view of the hook in each species is, as a rule, sufficient for diagnosis, the region of the body from which it is taken being indicated.

Terebellides stræmi, Sars, also comes from Portuguese East Africa in shallow water (2-3 fathoms) off Chefina Light. The distribution is wide, for it extends from the Arctic seas to the shores of the North Sea and the Western Atlantic, as well as to the seas of Australia. It is, indeed, cosmopolitan.

Family Sabellidæ.

Potamilla reniformis, O. F. Müller, was dredged in 8-10 fathoms at Seal Islands. The branchial fan resembles that of *Sabella penicillus*, but the terminal processes of the filaments are very short. Externally the filaments are dappled at the base with reddish-brown specks, and a band of the same colour occurs about a third from the tip of the fan. The pinnæ are numerous and fine. The ventral scutes go to

the tip of the tail, the pygidium having a terminal anus with two reddish-brown specks like eyes on the dorsum. The bristles and hooks agree, on the whole, with the European form. The tube is translucent, hard, and tough, without an external coating, though a minute Maldanid in a translucent tube covered with minute sand-grains was attached in one case. In some the anterior end appears to have rolled up after the annelid had withdrawn into the tube. The species is found over a wide area, for it occurs in the Northern Seas, the Atlantic, North Pacific, and the Mediterranean.

Sabella indica, Savigny, was obtained at low water on the north-west side of Inhaca and on Polana beach—both in Portuguese East Africa. The branchial filaments are brownish or buff, with numerous touches of purple, so that the branchial region, which measures three-quarters of an inch in length, forms a somewhat dark mass. The basal touches of pigment form three rings, the rest are irregularly scattered. Each filament is buff-coloured, grooved externally, tapered at the tip, and with a very short free process. The piunæ are rather short, and diminish to small processes as they approach the tip. The collar is split into two large lateral flaps dorsally and two smaller ventrally—all speckled with purple touches both externally and internally. The tentacles are fully half the length of the branchial filaments, and are thicker than those of *Bispira*. The massive and rounded body—ruptured anteriorly—is about $2\frac{1}{2}$ inches in length, and shows a series of purple specks below each bristle-tuft throughout. The surface anteriorly is speckled with purple, and this probably extended further backward in life. The body tapers considerably to the dorsal anus, which has two lobate papillæ ventrally and two smaller dorsally. The anterior bristles show the usual groups. The longer series has slightly curved, tapering tips, and the wings are so reduced as to be almost invisible, yet the edges are serrated. The shorter have well-marked wings and similar tips. The smaller posterior bristles are likewise in two groups, with more elongated tips and diminished wings. The anterior hooks have the typical Sabellid shape with numerous small teeth above the main fang, a bluntly conical prow, and a well-marked posterior process. The inferior outline curves upward behind the prow. The posterior hooks are smaller, but agree in structure. This form corresponds to Savigny's *S. indica*, the *Sabellastarte indica* of Prof. Willey and other authors. Prof. Willey* found an

* Ceylon Pearl Oyster Fisheries Supplem. Rep. Polychæta, p. 311 (1905).

abnormal example, with only six thoracic segments, procured on the Ceylonese pearl-banks. Schmarda's* *Sabella violacea*, from the Cape of Good Hope, if his artist can be trusted, is a *Dasychone* with external processes on the branchial filaments or radioles.

Bispira volutacornis, Montagu.—No locality, but probably from Cape waters. This form is widely distributed at the Cape. It occurs on the southern shores of Britain and in the Channel Islands as well as the shores of France and Spain, and probably extends to the Mediterranean.

Dasychone orientalis, M'Intosh, var., was dredged at various stations in Portuguese East Africa—chiefly off Inhaca and Chefina Light. A brilliantly tinted species with bands of red or purple on the branchiæ. On removal of the branchiæ, the two median dorsal processes with the fissure between them, and an outer inflection as the collar is joined are conspicuous. The collar is continued ventrally with an incurvation before joining the two flaps transversely (usually reflected) in the middle line: these flaps are often barred with purplish internally. Above and in front of the flaps are two thin leaf-like processes in connection with the mouth. The branchiæ have the pigment both on filaments and pinnæ, so that they are brightly coloured. The filaments are of moderate length, and the tips of many appear to be injured, probably by a marauding fish. In any case the terminal process is short and smooth. Externally the filament has paired processes like two ridges—which rise from the level and end abruptly distally in a blunt point as figured in the 'Challenger' Annelida†. Some examples have brownish branchiæ, in one case brown touches of pigment like eyes are situated about the middle of each of the external processes of the filament. The body is about $2\frac{1}{2}$ inches in length, rounded dorsally and flattened ventrally, little tapered till it approaches the tail, where the diminution is more distinct, and terminating in a bilobed anus, the halves being lateral. The copragogue is distinct, and slanting cuts off, as a rule, eight anterior bristled segments. The bristles and hooks correspond with those of the 'Challenger' species, the anterior hooks having five or six teeth above the main fang. The tube resembles that of *Sabella penicillus*, but it is less tough and perhaps more cylindrical, though the posterior end is generally diminished. One is

* Neue Wirb. Th. ii. p. 34.

† Pl. xxxix A. fig. 4.

surrounded by a coating of *Membranipora*, and in others a little brownish mud coats the tube. The differences between the South African form and *D. orientalis* of the 'Challenger' consist in the absence of a hiatus in the collar in its progress to the ventral surface, and in the absence in some of the pigment speck between the setigerous process and the row of hooks posteriorly. In the structure of the bristles, hooks, and branchiæ it is closely allied, though the distal ends of the processes on the branchial filaments are blunt. The Cape form is also somewhat larger. *D. picta*, M'I., from Japan, has similar processes, but no blunt point, for they terminate in a simple angle. *D. capensis*, again, has long clavate processes, whilst *D. violacea*, also of the 'Challenger'—with lobulated processes of a different kind,—has pigment-spots between the bristles and hooks.

Dasychone argus, Sars.

The first variety of this form was dredged in 8 fathoms off Chefina Light, Portuguese East Africa. In this form, the more elongate branchial filaments are marked with touches of brownish red, perhaps purple before preservation, and the external appendages have longer processes at the peaks distally than in the foregoing form (*D. orientalis*), in this respect resembling those of *D. nigromaculata* of the 'Challenger.' A distinct terminal filament occurs at the tip, the pinnae diminishing to papillæ at its base. Brownish-red pigment occurs at the anterior third of the external processes, but such did not appear to merit the name of eyes. The collar is typical. There are about sixty bristled segments behind the eight thoracic, a number of minute ones occurring at the tip of the tail. The copragogue cuts the right corner of the 8th ventral shield. The perivisceral cavity was crowded with ova. The small terminal anus does not show a bilobed condition, but it may have been injured. The bristles offer no feature of distinction. The anterior hooks have short necks curved like an S, with a boldly convex anterior prow and a short posterior process. Four teeth occur above the main fang, the posterior have three or four.

The second variety was dredged in Cape waters (No. 39) in 85 fathoms on mud. It was also obtained off the Cape (No. 41, Station 93) in 90 fathoms on sandy mud. In this form the collar passes downward from the dorsal dimple to the fissure in the ventral border with only crenations on the edge. The branchiæ are proportionally long, pale, and marked by two reddish pigment-specks at regular intervals, and ending

distally in a short free filament. The external processes on each filament are of the same type as those of *D. argus*, though smaller. The body ends in an anus with pale papillæ. A red speck is situated between each bristle-tuft and the hooks, and the bristles and hooks are typical, though the crowns of the hooks are, perhaps, less elevated. This species ranges from the Mediterranean to the northern and western shores of Europe, to the Atlantic and other seas. It is possible that the *Dasychone capensis* of the 'Challenger' may have relationships with Schmarda's *Sabelluviolacea*, as well as with *D. argus*. The 'Challenger' dredged it off the Cape in 150 fathoms, December 18, 1872, lat. 35° 4' S., long. 18° 37' E., bottom-temperature 47°·0, surface-temperature 65°·5, bottom green sand.

Family Serpulidæ.

Hydroides norvegica, Gunnér, var.

Dredged at various stations (34, 92, 111) off the Cape on muddy ground, one being attached to the tube of *Dasychone orientalis*. The opercular stalk springs from the dorsal edge of the right branchial fan, and has the soft, grooved, crenate cup, the marginal notches being more deeply cleft than in the European *H. norvegica*. In the centre of this is a crown of 9-11 yellowish, spiked, horny rays projecting upward like petals from a ring of sepals. Whilst at first sight this apparatus resembles that of the *H. norvegica* of Europe, a closer scrutiny reveals considerable diversity. In the first place, the spines, in preservation, are erect, each has a thinner main axis, and the extremity is boldly hooked, as if furnished with a strongly curved and glistening claw. From the sides of each stiff chitinous process from three to five sharp and slightly curved spines project, the length of these increasing from below upward. In the European form there are 16 or 17 of the corresponding rays in the crown. The basal saucer is soft and has the usual series of radiating narrow segments, the edges being cut more deeply. The spinous apparatus can be expanded into a circular disc by muscular action, and closed by the same means. It is thus a formidable organ of defence, for the sharp hooks at the ends of the radii and the spines on their borders would entangle an intruder beyond rescue. The rudimentary (left) operculum is a smooth club-shaped organ, without indication of the horny processes. The filaments of the branchiæ have long smooth tips and the pinnæ are comparatively long. The first set of bristles are yellowish, and the stronger forms

have the two spurs and the long tapering distal whip—the serrations of which are almost invisible. There is less enlargement at the end of the shaft, and the spurs differ in shape from those of the European form. Simple bristles with finely tapered tips are also present. So far as can be observed, there are 5–6 lateral tufts of bristles besides the first, six being the most common. The anterior or thoracic bristles consist in each tuft of a longer and a shorter series of simple bristles with hair-like tips, the wings being so narrow as to be almost indistinguishable. The anterior hooks have six teeth above the main fang, though in the European traces of a seventh at the summit are sometimes met with, as in *H. multispinosa*, Marenzeller, and the posterior have sometimes fewer. The calcareous tube is externally like that of *H. norvegica*, and is often fixed to neighbouring tubes. When fractured it seems to be vitreous internally.

In considering the relationships of this form, it has to be remembered that the chitinous circle of the operculum in *H. norvegica* varies in its armature, some forms having smaller lateral spines on the edges of the radii, others having much larger dagger-like processes, and their number likewise differs. There is little regularity in their sizes either on the edges or upper (inner) surface of the radii. The tips of the radii, again, offer several variations, and apparently in many the tissue is thinner and more easily affected by the preservative fluid, since in old preparations, *e.g.*, those of 1863, the lateral spines are curved round the axis and the softened flap appears to be hooked. In others, *e.g.*, from Herm (1868), the elongate-lanceolate tip remains straight with perhaps, in a few, a trace of a minute hook at the tip. Some have fewer spines on the inner surface of the rays than others, and these occur only at the bases of the rays so as to form a ring of spikes round the centre. The reduction in the number of the rays in the superior calyx is marked in *H. perezii*, Fauvel*, in which there are only six, and these ovoid processes have a hook at the tip, after the manner of the Cape form, but are devoid of lateral spikes. The genus, indeed, presents remarkable opercula, such as the double tier of bifid processes in Grube's† *H. minax* from the Philippines and Marenzeller's‡ *H. multispinosa* from Japan, which has the edge of the inferior saucer cut into segments, and the eleven horny radii of the

* Arch. Zool. Expér. t. 58, Fas. 8, p. 463 (1919).

† Beiträge Annel. Philip. p. 269, Taf. xv. fig. 5.

‡ Sudjap. Annel. Denksch. d. K. Akad. Wien, Bd. 49, p. 216, Taf. iv. fig. 2.

upper series terminated by a blunt button-shaped process. Still more remarkable are those described by Miss Helen Pixell (Mrs. Goodrich)*, her *Eupomatus spinosus*, from Suez, somewhat approaching the Cape form. Lastly, the recent addition to the British Fauna by Mr. Carmichael Munro †, viz., *Mercierella enigmatica*, Fauvel, shows a double series of simple hooks in the bulbous operculum, the form of its (smaller) tubes following the arrangement of those of *Hydroides*.

In conclusion, there remains the possibility of the European *H. norvegica* having undergone considerable changes in the more genial waters of the Cape.

Spiroribis spirillum, L.—Examples of both discoid and ascending or lax spiral forms occurred along with *Dasychone orientalis*, at Inhaca, Portuguese East Africa.

II.—*A Triassic Fauna from the Jordan Valley.* By LESLIE R. COX, B.A., F.G.S., Department of Geology, British Museum.

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[Plates I. & II.]

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* Trans. Linn. Soc. 2nd ser., Zool. vol. xvi. p. 69, pls. viii. & ix.

† Ann. & Mag. Nat. Hist. ser. 9, vol. xiii. p. 155, text-figs. C & D (1924).

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INTRODUCTION.

The fossils which are the subject of the present paper form a portion of the material collected during the spring of last year by an expedition organised to investigate the geology of the Dead Sea and Jordan Valley district. For

certain reasons the names of the members of this expedition cannot for the present be published, but these gentlemen have been good enough to place a portion of their interesting palæontological collection at my disposal for description. It is to be hoped that at some future date it may be possible for them to publish further facts relating to the stratigraphy and tectonics of this district, as details published by previous observers have been found inaccurate and incomplete. For such information as is contained in the present paper I am greatly indebted to the members of the expedition.

Undoubtedly the most important discovery is that of exposed Triassic rocks of a marine character in this district, as the presence of such was hitherto quite unsuspected. This discovery is of great interest as a further link in our knowledge of the Mediterranean Triassic province, the more so as the nearest Triassic exposures previously known are situated to the north-west, in Anatolia, and to the west, in Crete, each at a distance of well over a thousand miles, and in these regions an entirely different facies is presented.

As will be seen from the present paper, investigation of the collection made from this Triassic deposit discloses the fact that a very peculiar association of species is met with; the significance of this will be discussed at the end of the paper.

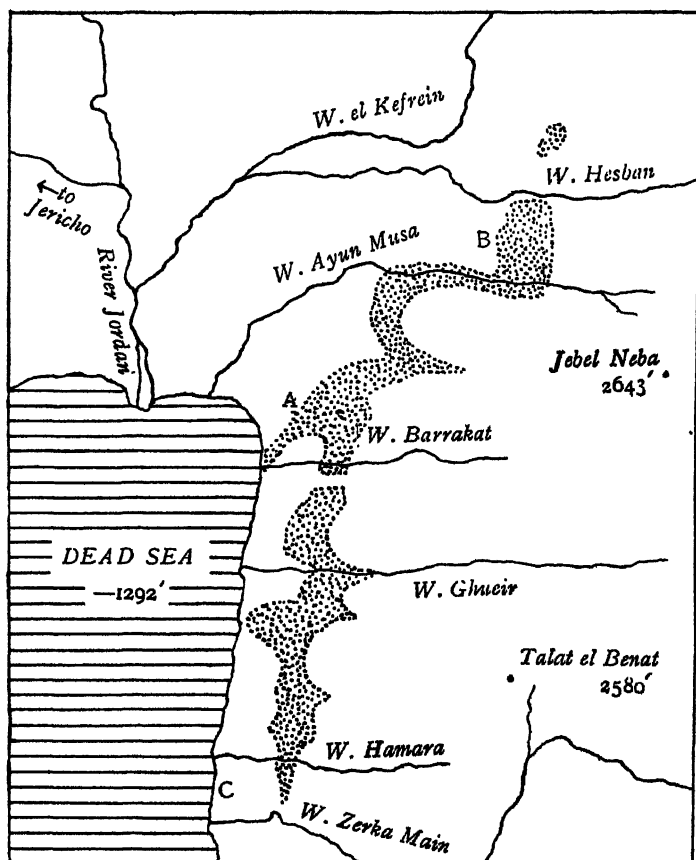
LOCALITIES.

The localities from which the fossils described were collected are situated in the district bordering the N.E. corner of the Dead Sea. The extent of the exposure of the fossiliferous Triassic rocks is shown in the map.

For some distance to the north of Wadi Zerka Main the cliffs rise steeply from the water's edge, but north of W. Ghueir they are not so steep and the beach is accessible in numerous places. From this point the escarpment recedes in a N.N.E. direction; between it and the alluvial plain of the Jordan lies a stretch of undulating land of quite feeble relief, dissected by numerous shallow wadis, tributary valleys of the Jordan and the Dead Sea. To the east the ground rises fairly rapidly until the prominent Senonian escarpment is reached some ten miles away. In this latter region the wadis become deeper and more steeply sided.

The Triassic outcrop sweeps across the stretch of feebly undulating land, the majority of the fossils having been collected in the neighbourhood of W. Hesban and W. Ayun

Musa. Some, however, were obtained further south, in the neighbourhood of the Dead Sea shore, between W. Ayun Musa and W. Ghueir. The actual outcrop extends as far south as W. Zerka Main.



Map showing extent of the fossiliferous Triassic exposure (dotted). Scale:—1 : 250,000 (1"=4 miles approx.). A. Locality of laminated marl with *Discina*; B. Locality of Sandstone with *Lingula*; C. Locality of Cambrian exposure, from which the fossils recently described by W. B. R. King (Geol. Mag. 1923, pp. 507-514) were collected.

Patches of fossiliferous Triassic rock were also met with further north than the district included in the map, at a point about 4 miles S.E. of Es Salt, and at El Bukaa, 4 miles N.E. of Ain Homar.

STRATIGRAPHICAL DETAILS.

The fossiliferous Triassic beds are underlain and overlain by unfossiliferous sandstone of the general "Nubian Sandstone" type. The beds themselves consist of a calcareous series above and an arenaceous series below.

In the neighbourhood of Wadi Heshan the calcareous beds are from 100' to 150' in thickness, but thin rapidly to the east and die out completely within two miles. Thus these fossiliferous beds have the form of a wedge inserted in the Nubian Sandstone. Nearly all the fossils were obtained from the upper half of this calcareous series, which consists of thin-bedded yellow and brownish limestones, 1' to 2' in thickness, separated by beds of calcareous marl of about the same thickness. These marl beds yielded abundant specimens of *Cænothyris vulgaris*, with lamellibranchs and ammonite fragments. The lower half of the calcareous series did not yield any fossils. It consists of grey compact limestone beds 2' to 3' in thickness, separated by rubbly beds composed almost entirely of curiously shaped cylindrical bodies. The exact nature of these cannot be ascertained. They may be of concretionary origin, or possibly casts of annelid tubes. They average $\frac{1}{2}$ " in diameter, are round or slightly flattened in cross-section, are straight or curved, sometimes branching, and smooth or with small bosses.

Further south, at Ayun Musa, *Cænothyris vulgaris* is less abundant than the lamellibranchs, but the latter are for the most part poorly preserved. The limestone series is here seen to be underlain by 300' to 400' of yellow or greyish sandstone with some argillaceous beds. This sandstone yielded a species of *Lingula* and some lamellibranch casts. Some vague impressions may also indicate plant-remains.

Below this yellow sandstone series in Wadi Ghueir is a red massive sandstone series with some green shale-bands. The transition from red to yellow is very well defined.

Other fossiliferous rock-types collected from the more southerly exposures are:—(a) a very soft yellow laminated sandy marl with *Discina* sp. This occurred in the upper part of the sequence, about half-way between W. Ayun Musa and W. Ghueir, at the point marked A on the map; (b) a very hard compact oolitic dolomitised limestone, from W. Barrakat, also from the upper part of the sequence. The spherical oolitic grains, in which a beautiful concentric structure is visible under the microscope, are cemented together by recrystallised dolomite. This rock contains a number of lamellibranch remains too poorly preserved for determination.

PREVIOUS OBSERVATIONS.

In view of the extremely fossiliferous nature of the deposit—in particular the large number of weathered-out specimens of *Cænothyris vulgaris* to be collected—it is remarkable that it has escaped the notice of previous explorers.

A few details of the geology of this district are to be found in the works of Lartet*, founded on observations made on the expeditions of the Duc de Luynes in 1865–66, and, more recently, in the publications of Blanckenhorn †. Other observations of a more general character have been published by Kersten, Musil, Rothe, Abel, Cady, and others (see references given by Blanckenhorn). The early American expedition, the official report of which was published by Lynch in 1852, paid only a hasty visit to the neighbourhood.

Such authors have mapped and described the unfossiliferous Nubian Sandstone as occurring beneath the fossiliferous Cretaceous rocks, and as being exposed in the district bordering the N.E. corner of the Dead Sea, of which it forms the cliffs. The presence of any fossiliferous intercalation has hitherto been unsuspected. Blanckenhorn has denied the presence of any Mesozoic rocks in the district of age earlier than Cretaceous, to which formation he assigns the unfossiliferous sandstone.

PALÆONTOLOGY.

I proceed to a description of all those fossils collected to which a Triassic age is assigned. The relative ages of the beds found at the several localities will be discussed at the end of the paper; it will there be suggested that the time-range of the whole sequence is not very great.

In preparing the following account I must acknowledge my indebtedness to my colleagues Dr. C. W. Andrews and Dr. L. F. Spath, the former for giving me a description of the Nothosaurian bone, the latter for similar help with the cephalopod remains. I am also greatly indebted to Dr. F. A. Bather for many helpful suggestions.

All the fossils referred to in the description have been presented to the Geological Department of the British Museum, and are cited individually by their registration-numbers.

* Essai sur la Géol. de la Palestine, Paris, 1869, pp. 126, 149, etc.; Exploration géol. de la Mer Morte, Paris, 1877.

† Naturw. Studien am Toten Meer und im Jordantal, Berlin, 1912, pp. 232–245; Syrien, Arabien u. Mesopotamien, Handb. Reg. Geol. Bd. v. Abt. 4, 1914, pp. 78–81.

BRACHIOPODA.

Family Terebratulidæ.

Genus CÆNOTHYRIS, Douvillé, 1880.

Cænothyris vulgaris, Schlotheim, sp. (Pl. I. figs. 1-3.)*Terebratulites vulgaris*, Schlotheim, 1820, p. 275; 1823, pl. xxxvii. figs. 5-9.*Terebratula vulgaris*, Schloth.; Giebel, 1856, p. 55, pl. vi. figs. 10, 12.*Terebratula (Waldheimia) vulgaris*, Schloth.; Seebach, 1881, Zeitschr.

Deutsch. Geol. Ges. xiii. p. 561, pl. xiv. fig. 1.

Terebratula vulgaris, Schloth.; Koschinsky, 1878, Zeitschr. Deutsch. Geol. Ges. xxx. pp. 375-385.*Terebratula (Cænothyris) vulgaris*, Schloth.; Bittner, 1890, p. 5.

A large number of *Terebratula*-like brachiopods were obtained, all of which prove referable to this species. In many of the specimens the shell is preserved entire, others have been more eroded, and in one (B. 4177?) the complete erosion of the shell has laid bare a perfectly preserved internal cast. Attempts to examine the brachial skeleton by means of sections failed. On account of the variability of the species a description of these specimens is given, and two extreme forms are figured.

*External Characters**.—Subequivalve. Fairly gibbous. Circular to elongate-ovoid, anteriorly rectimarginate or slightly uniplicate. Promesothyrid or epithyrid. Beak incurved, leaving little room for the symphytium.

Internal Cast.—Ventral surface with a very prominent median ridge extending anteriorly from position of foramen for a distance nearly a third the length of the shell, and indicating the presence of a very deeply-set series of muscle-scars in the ventral valve. Dorsal surface with a narrow groove extending anteriorly from the umbo for a distance nearly a half the length of the valve, and corresponding to a well-developed median septum. Diverging from this at angles of about 30° are two grooves of nearly the same length, limiting raised portions of the cast which mark the positions of attachment of the anterior adductors. The grooves themselves correspond to lateral inclined septal plates supporting the hinge-plates. Along the hinge-line two pits in the cast of the dorsal valve show that well-developed hinge-plates were present. The inner margins of these plates met in an acute angle at the umbo of the dorsal

* The descriptive terms used are those employed by S. S. Buckman
Pal. Indica, n. ser. vol. iii. Mem. No. 2 (1917).

valve. Two pits, one each side of the foramen, correspond to the teeth of the ventral valve. Dental plates were apparently absent.

Dimensions.—Largest specimen: length 25.5 mm.; breadth 20.5 mm.; thickness 13.8 mm.

The internal features agree well with those descriptions of the *Muschelkalk* species given by the above authors. In external form the species is extremely variable. Many of the German specimens attain larger dimensions and are more biplicate than those here described, but smaller ovoid forms occur at some horizons.

Localities.—W. Hesban (B. 44770-95); W. Ayun Musa (B. 44796-800); half-way between W. Ayun Musa and W. Ghueir, on N.E. shore of Dead Sea (B. 44801-2).

Previous Records.—Abundant in lower and upper stages of German* *Muschelkalk*. Rare in Lettenkohle. In the Marine Mediterranean and Asiatic Trias widespread in beds of *Muschelkalk* (Auisic) age, and known also from Ladinic deposits.

Family Lingulidæ.

Genus LINGULA, Bruguière, 1797.

Lingula cf. *tenuissima*, Bronn, var. *zenkeri*, Alberti.
(Pl. I. fig. 4.)

Cf. *Lingula zenkeri*, Alberti, 1864, Ueberbl. ü. Trias, p. 161, pl. vi. fig. 4.

Cf. *Lingula* sp., Bittner, 1890, p. 129, pl. xxxix. fig. 28.

The shiny, dark brown chitinous test of this species is well preserved in a yellow sandstone. The general contour is rectangular, the lateral margins very slightly convex and forming angles slightly greater than right angles with the straight anterior margin, of which the width is about $\frac{2}{3}$ the maximum width of the shell. The latter is attained about half-way between the umbo and the anterior margin. The central posterior portion of the shell is somewhat inflated and limited by two rounded obtuse angulations originating at the umbo and diverging toward the anterior corners of the shell, but becoming obsolete before reaching these.

Dimensions.—Largest specimen: length ca. 17 mm. (extreme posterior portion missing); width 10.5 mm.

* The term "German Trias" will be used in the following descriptions to include also such areas as Spain and N.W. Africa, where the development of the system is very similar to the typical development in Germany.

Alberti considered two species of *Lingula* to be represented in the German Trias, the typical *L. tenuissima*, Bronn, elongate-ovoid in contour, with convex anterior margin, and *L. zenkeri*, Alb., more rectangular in form, with nearly straight anterior margin. The former was stated to occur at the more calcareous horizons, while the latter was cited from the Lettenkohle. Zeller (1907 *a*, p. 113) states that it is impossible to maintain these as distinct species, all intermediate gradations occurring. In the Lettenkohle, however, the var. *zenkeri* is by far the most common form, attaining a length of over 20 mm. just below the Grenz dolomit. The Lettenkohle specimens, according to Zeller, are white or brown in colour.

Of the specimens figured by Bittner from the Alpine Trias, that bearing most resemblance to the present species is the one above cited, from the Raibl Beds of Lombardy. It is slightly narrower posteriorly than the Palestine specimens.

Locality.—Wadi Ayun Musa (B. 44803).

Family Discinidæ.

Genus *DISCINA*, Lamarck, 1819.

Discina sp.

A flattened valve imperfectly preserved in a very soft yellow laminated marl. The posterior portion has been destroyed. Outline circular. The concentric growth-stages are crossed obliquely by extremely fine sinuous threads.

Dimensions—13 mm. diam.

Hitherto all specimens of *Discina* found in the German Trias have been referred to *D. discoides* (Schlotheim). Specimens from the Wellenkalk closely comparable with the Palestine specimen have been figured by Assmann (1916, pl. xxx. figs. 3 & 4). The majority of specimens hitherto described from the marine Trias, mostly without specific identification, attain much smaller dimensions. Tommasi (1890, p. 68) describes a specimen from the Raibl Beds of Friuli of diameter 19 mm. This he compares with the Rhætic species *D. babeana*, d'Orb.

Locality.—N.E. shore of Dead Sea, between W. Ayun Musa and W. Ghueir (B. 44804).

LAMELLIBRANCHIA.

Family Nuculidæ.

Genus NUCULA, Lamarck, 1799.

Nucula sp. (Pl. I. fig. 5.)Of. *Nucula expansa*, Wissmann; Bittner, 1895, p. 140, pl. xvii. figs. 25-33.

A specimen agreeing in its general form and proportions with the St. Cassian specimens figured by Bittner, but somewhat larger. The angle formed at the umbo by the anterior and posterior dorsal margins is slightly less than 90°. The anterior dorsal margin is quite straight, that of the majority of Triassic species being convex or angulated.

Dimensions.—Length 10.1 mm.; height 8.8 mm.

Locality.—Wadi Hesban (L. 33300).

Family Pteriidæ.

REUBENIA, gen. nov.

Etym.—Reuben (Numbers, ch. 34, vv. 11-15. "For the Tribe of the children of Reuben . . . have received their inheritance on this side Jordan . . . eastward").

Diagnosis.—Shell strongly inequivalve. Left valve inflated, with umbo prosogyrate and incurved over extreme anterior end of long straight hinge-margin. Inflated umbonal region with central depression, limited anteriorly by a sharp ridge, separating an extremely oblique anterior area, and posteriorly by a rounded carination which runs across central portion of shell and dies out near postero-ventral angle. Hinge-margin produced posteriorly past inflated portion of valve, forming a wing-like projection. Right valve concave along axis joining umbo to postero-ventral angle. Ligament internal, in narrow groove extending posteriorly from umbo, parallel to, and just beneath, cardinal margin. Surface of shell smooth, except for growth-striae.

Remarks.—The above diagnosis is based on the characters of the two new species *R. hesbanensis* and *R. attenuata*. Of these, *R. hesbanensis* is designated as the genotype. The left valve only of this species is known, knowledge of the external form of the right valve of the genus being derived from the second species, *R. attenuata*.

The genus is closely related to the well-known Triassic genera *Hoernesia* and *Cassianella*, and also to the little-known genus *Lilangina*, Diener (Pal. Indica, ser. xv. vol. v. mem. 3, 1908, p. 62). The species of all these genera are similarly inequivalve, with the umbo of an inflated left valve curving anteriorly over the hinge-margin.

Hoernesia joannis austriæ (Klipst.), from the St. Cassian beds, the typical species of the genus, possesses a thick cardinal area and a multivincular ligament. This character would ally it to the Pernidæ rather than to the Pteriidæ. The genus *Cassianella*, typified by the St. Cassian species *C. gryphæata* (Münst.), also possesses a thickened cardinal area, with only one ligament-pit running posteriorly and obliquely from the umbo. This feature would place it in the Pteriidæ. Bittner has, however, shown that any generic distinction based on this character is untenable, as a duplication of the ligament-pit may occur in a species of *Cassianella*, while *Hoernesia bipartita* (Merian) possesses only one ligament-pit. The only distinctive character is the position of the umbonal furrow, limited anteriorly by the umbonal septum. In *Hoernesia* this occupies a median position on the umbonal inflation, in *Cassianella* it is anterior to this inflation, and merely limits the anterior wing.

The third genus of the group, *Lilangina*, to which the Palestine species appeared at first sight to belong, was founded on one species, *L. nobilis*, Diener, from the Carnic deposits of Spiti. The details of the hinge-structure of this species have not yet been described, but a thickened external cardinal area is present, on which one triangular ligamental groove runs in a somewhat posterior direction from the umbo, just as in the species *Cassianella decussata* (Münst.). In the position of its umbonal furrow *L. nobilis* resembles the genus *Hoernesia*. The main distinctive generic character, in virtue of which this species was separated by Diener, was the form of the anterior portion of the shell, each valve being almost truncated anteriorly to a carina running ventrally from the umbo, and there being no trace of any anterior wing to the shell. In addition, the umbo was to a very marked extent prosogyrate. It seems doubtful if the absence of anterior wing is sufficient basis for generic distinction, as in some species of *Hoernesia* this wing is almost obsolete.

In their external form the species of *Reubenia* resemble *Lilangina nobilis* more closely than any species of *Hoernesia* or *Cassianella*, and they are almost truncated anteriorly in a similar manner. In *R. hesbanensis* there is, however, a very

short anterior projection of the hinge-margin which gives rise to a scarcely definable anterior wing.

The main distinguishing feature of the genus *Reubenia* is the entire absence of any thickened external ligament-area, and the direction taken by the narrow ligament groove, parallel to the hinge-margin.

The three genera *Hoernesia*, *Cassianella*, and *Lilangina* also resemble one another in the presence of an internal umbonal septum in the left valve, corresponding in position to the carina which limits the anterior area. The presence of such a septum in the genus *Reubenia* has, owing to lack of material, not been actually observed, but is probable.

Reubenia hesbanensis, sp. n. (Pl. I. figs. 6 a, b, c.)

Left valve only known.

Diagnosis.—Shell wide. Length only slightly exceeding height (ratio about 5:4). Extreme postero-ventral angle slightly anterior to posterior extremity of hinge-margin. Margins of shell approximately in one plane.

Description.—This shell is almost truncated anteriorly, but an extremely small anterior wing is present. The holotype (L. 33301) also possesses a pointed posterior wing-like projection to the valve, the growth-lines curving outward at the hinge-margin. This feature is variable, as in another specimen (L. 33302) assigned to the same species no such pointed wing is developed. Internally a small tooth-like protuberance, with nodular extremities, exists some distance below the posterior portion of the cardinal margin (L. 33301). The umbo curves right down over the hinge-margin, obscuring the latter from view at this point, so that the right valve must have been extremely concave.

Dimensions of Holotype.—Length 31 mm. ; height 24 mm.

Locality.—Wadi Hesban (L. 33301–3).

Reubenia attenuata, sp. n. (Pl. I. figs. 7 a, b, c.)

Diagnosis.—Shell narrow. Length considerably greater than height (ratio slightly exceeding 3:2). Postero-ventral angle a long way posterior to posterior extremity of hinge-margin. Postero-ventral portion of the shell twisted far beneath and beyond plane of the cardinal region.

Description.—The holotype (L. 33304), the only specimen known, is complete with both valves in position. The shell is somewhat eroded anteriorly, but there is no trace of any anterior wing. Posteriorly the growth-lines curve inwards

to meet the hinge-margin. The right valve is very concave along the axis joining the umbo to the postero-ventral angle, but convex along the axis at right-angles to this. The resultant form is concave. The details of the hinge-structure are completely hidden by the right valve.

Dimensions.—Length 26 mm.; height 15.5 mm.

Locality.—Wadi Hesban (L. 33304).

Reubenia sp. (Pl. I. fig. 8.)

This little specimen, a left valve, is undoubtedly a representative of another new species, but is probably juvenile, and for this reason is not here named.

Description.—Shell narrow. Length considerably greater than height (ratio slightly exceeds 3:2). The ventral margin, just before reaching the postero-ventral angle, is almost parallel to the cardinal margin, and is not twisted under and beyond the plane of the latter. A very feebly-developed anterior wing is indicated. Posteriorly the growth-lines meet the hinge-margin almost at right angles. The hinge-details, as far as it has been possible to prepare them for observation, agree with the generic characters founded on the hinge of *R. hesbanensis*.

Dimensions.—Length 7.8 mm.; height 4.8 mm.

Locality.—Wadi Ayun Musa (L. 33305).

Family Halobiidæ.

Genus *DAONELLA*, Mojsisovics, 1874.

Daonella sp. (Pl. I. fig. 15.)

An imperfectly preserved right valve.

Description.—The umbo is situated towards the anterior end of the hinge-line, which is rounded off at its junction with the lateral margin. No anterior ear is demarked. The surface-ornamentation of fine radial ribs is most developed on that portion of the surface posterior to the umbo. The posterior portion of the hinge-margin and also some of the ventral margin is missing. Apparently the shell was obliquely elongated in a postero-ventral direction. The growth-lines indicate that it was more symmetrical in its earlier stages.

Dimensions.—Length 18 + mm.; height 10 + mm.

This species appears to belong to the group of *D. pichleri*, Mojs., but is too poorly preserved for identification.

Locality.—W. Ayun Musa (L. 33320).

Family Ostreidæ.

Genus OSTREA, Linné, 1758.

Subgenus LOPHA, Bolten, 1798.

[*Alectryonia*, Fischer de Waldheim, 1807.]*Ostrea (Lopha) montis caprili*, Klipstein. (Pl. I. figs. 9-11.)*Ostrea montis caprili*, Klipstein, 1815, Beitr. geol. Kenntn. Östl. Alpen, i. 3, p. 247, pl. xvi. fig. 5.*Ostrea montis caprili*, Klipst.; Wöhrmann, 1889, p. 200, pl. vi. figs. 1-3.*Ostrea montis caprili*, Klipst.; Tommasi, 1890, p. 13, pl. i. fig. 3.*Ostrea montis caprili*, Klipst.; Bittner, 1901, p. 74, pl. vi. figs. 14-18.*Ostrea montis caprili*, Klipst.; Frech, 1912, p. 31, pl. v. fig. 1.

A number of specimens occur of a small plicated oyster. In view of the fact that *O. montis caprili*, the earliest-known species of *Ostrea*, has not been recorded in deposits of pre-Ladinic age, the generic determination of these specimens is of importance in fixing the horizon. The small plicated oyster-like bivalves which are abundant in the German Trias from the base of the Muschelkalk upwards, and occur also at all horizons of the Alpine Trias, are now known to be attached by their right valves, and hence to be more nearly related to the genus *Plicatula* than to *Ostrea*. For such forms, which externally are scarcely to be distinguished from true oysters, Bittner has introduced the generic name of *Enantiostreon*.

It has not been found possible to locate the position of the muscle-scars in any of the valves of which the interiors could be examined, and so to determine directly on which valve the area of attachment lies. The features relied upon, therefore, are the form of the apex and the nature of the ligamental area.

Our knowledge of these features in the Muschelkalk species of *Enantiostreon* is due to the researches of Noctling*. As figured by him†, the ligament-area is seen to be very irregular in form, the ligamental groove rectangular rather than triangular. The apex of the left (unfixed) valve is illustrated in his fig. 1 a, and is seen to be twisted posteriorly. By analogy the apex of the right (fixed) valve, if preserved, would also be twisted posteriorly, i. e. to the "right," when viewed from an internal position.

* Zeitschr. Deutsch. Geol. Ges. xxii. 1880, p. 321, pl. xiii.

† See also Frech, 1912, p. 30.

To turn now to *Ostrea montis caprilis*, we find the apical characters of this species illustrated by Wöhrmann (1889, pl. vi. figs. 2-3), and subsequently discussed by Bittner (1901, p. 74). Bittner points out an important mistake made by Wöhrmann, in that the latter has confused the right valve with the left, his fig. 2 representing the ligament-area and apex of the left (fixed) valve and not the right valve as stated. With this figure may be compared that given by Healey (1908, pl. v. fig. 18 b) of the left valve of *Ostrea* cf. *haidingeriana*, a species to be regarded as the direct successor of *O. montis caprilis*.

These figures disclose the fact that, as in the genus *Enantiostreon*, the apex of the left valve is twisted posteriorly. The left valve is now the fixed valve. Hence it follows that in the true oyster, *O. montis caprilis*, the apex of the fixed valve is twisted to the "left," while in the genus *Enantiostreon* the apex of the fixed valve, if preserved, is twisted to the "right." These figures also indicate the presence of a well defined, obtusely triangular ligamental area and a triangular ligament-pit in the true oyster.

One of the specimens now described (L. 33307) is a fixed valve, on which the area of attachment is well defined and in which the extreme apex and ligamental area are well preserved. The twist of the apex to the "left," combined with the triangular ligamental area, closely recalling the two figures above cited, leaves no doubt as to the determination as a true oyster.

Localities.—Wadi Ayun Musa (L. 33306-8, L. 33310) Wadi Hesban (L. 33311-2), N.E. shore of Dead Sea between W. Ayun Musa and W. Ghucir (L. 33309).

Previous Records.—Ladinic and Carnic stages of marine Mediterranean Trias. Lettenkohle of Tunis.

Family Spondylidæ.

Genus *PLICATULA*, Lamarck, 1801.

Plicatula moabensis, sp. n. (Pl. I. fig. 12.)

Diagnosis.—Outline subcircular. Right (fixed) valve very slightly convex, with a large surface of attachment. Left valve almost flat. Shell thick, ornamented only by irregular protuberances of the shell-surface and by accentuations of growth-stages.

Dimensions.—Length 23.8 mm.; height 27.2 mm.

This species is not closely comparable with any previously

known Triassic form. Its main distinctive character is the entire absence of radial ornamentation.

Locality.—Wadi Hesban (L. 33313).

Subgenus *PSUDOPLACUNOPSIS*, Bittner, 1895.

Plicatula (Pseudoplacunopsis) fissistriata, Winkler, sp.
(Pl. I. figs. 13–14.)

Anomia fissistriata, Winkler, 1861, Zeitschr. Deutsch. Geol. Ges. xiii. p. 467, pl. v. fig. 10.

Plicatula archiaci, Stoppani, 1863, Couches à *A. contorta*, p. 140, pl. xxxiii. figs. 1–6; pl. xxxiv. figs. 4–5.

Placunopsis fissistriata (Winkl.); Wöhrmann, 1889, p. 201, pl. vi. figs. 7–8.

Several specimens occur of this species, which is characterised by its oval contour, irregularly spaced concentric growth-stages, and surface-ornamentation of fine radial striæ.

One specimen (L. 33315) is a right valve, of which the interior is visible. The depression, which, apparently, is the muscle-scar, is slightly dorso-posterior to the centre of the valve. Two diverging cardinal teeth are visible, proving the correctness of the reference of the species to the genus *Plicatula*.

The majority of authors, while considering *archiaci*, Stopp., to be synonymous with Winkler's species, have overlooked the obviously plicatuloid hinge figured by Stoppani and have referred the species to the genus *Placunopsis*. A reference to the descriptions of these authors shows that they have dealt with specimens in which it was impossible to observe the hinge-structure. Bittner (1895, pp. 212, 214) points out that, if Stoppani's figures are correct, the species cannot be a true *Placunopsis* because of its dentition, but that it shows some affinity to this genus, more particularly in the greater inflation of the left than of the right (fixed) valve, a condition reversed in the genus *Plicatula*. While leaving the generic position of *fissistriata* open, he proposes the subgenus *Pseudoplacunopsis* for a St. Cassian species (*P. affixa*) which, in dentition and relationship of one valve to the other, is similar to *fissistriata*.

The present confirmation of Stoppani's description of the dentition of *fissistriata* indicates that this species also should be referred to *Pseudoplacunopsis*.

Localities.—Wadi Hesban (L. 33314–6), W. Ayun Musa (L. 33318).

Previous Records.—Widely distributed in the U. Trias and Rhætic of the Mediterranean area and E. Indies.

Family Anomiidæ.

Genus *PLACUNOPSIS*, Morris & Lycett, 1853.*Placunopsis* cf. *ostracina*, Schlotheim, sp.*Chamites ostracinus*, Schlotheim, 1820, p. 215.*Placunopsis ostracina* (Schloth.), Philippi, 1898, Württemb. Naturw. Jahreshft, liv. p. 150, pl. vii. fig. 10 (with synonymy).*Placunopsis ostracina* (Schloth.), Assmann, 1916, p. 596, pl. xxxi. figs. 5-8.

A small specimen, elliptical in contour, with no trace of radial ornamentation.

Dimensions.—11 mm. × 7 mm. approx.

Locality.—Wadi Ayun Musa (L. 33319).

Previous Records.—German Trias, Lr. Muschelkalk to Keuper. Mediterranean Trias, Anisic Stage (Alpine Muschelkalk).

Family Pectinidæ.

Genus *Pecten*, Müller, 1773.[Vel genus *Pseudomonotis*, Beyrich, 1862.]*Pecten* [*Pseudomonotis*] *inæquistriatus*, Münster.
(Pl. I. fig. 16.)*Pecten inæquistriatus*, Münster; Goldfuss, 1833, p. 42, pl. lxxxix. fig. 1.*Pecten inæquistriatus*, Münster; Zieten, 1833, p. 69, pl. liii. fig. 3.*Monotis alberti*, Goldfuss, 1836, p. 138, pl. cxx. fig. 6.*Monotis alberti*, Goldfuss; Noetling, 1880, Zeitschr. Deutsch. Geol. Ges. xxxii. p. 323, pl. xiv. figs. 1-4.*Pecten alberti*, Goldfuss; Philippi, 1898, Zeitschr. Deutsch. Geol. Ges. l. pp. 608-612.*Pecten inæquistriatus*, Goldfuss; Wurm, 1912, p. 103, pl. vi. figs. 8-10.*Pecten* (*Velopecten*) *alberti*, Goldfuss; Wurm, 1915, Zeitschr. Deutsch. Geol. Ges. lxvi. p. 448.

One specimen occurs of the inflated left valve of this species. Noetling figures four specimens of the species from different horizons of the German Trias. In the intensity of its radial ribbing, the present specimen may be compared with that figured by him from the Upper Muschelkalk. The ears are small and inconspicuous, approximately equal in size, and not definably separated from the disc of the valve. Thus the form is that of the typical *inæquistriatus* rather than that distinguished by Goldfuss as *alberti*.

Dimensions.—Length 9.5 mm.; height 9.5 mm.

The difficulty in drawing rigid distinctions between genera and even families in the case of many Triassic lammelli-branches is again illustrated by this species, of which the right valve has recently been figured by Wurm (1915). It is assignable on equally good grounds either to the genus *Pecten*, subgenus *Telopecten*, or to the genus *Pseudomonotis*, the latter being usually classed with the family Pteriidae.

Locality.—Wadi Hesban (L. 33321).

Previous Records.—Abundant in German Muschelkalk and Grenzdolomit. In the Mediterranean area widely distributed in beds of Werfenian and Anisic age; also recorded from the Ladinic Esino and Marmolata Limestones, and from beds of Carnic age in the Northern Calcareous Alps (*Toula*, 1909). Also known from the Lower Trias of the Salt Range and Siberia.

Subgenus *SYNCYCLONEMA*, Meek, 1864.

Pecten (*Syncyclonema*) aff. *discites*, Schlotheim, sp.

Pleuronectites discites, Schlotheim, 1820, p. 218; 1823, p. 111, pl. xxxv. fig. 3.

Pecten tenuistriatus, Münster; Goldfuss, 1833, p. 42, pl. lxxxviii. fig. 12.

Pecten discites, Hehl; Goldfuss, 1836, p. 73, pl. xcviii. fig. 10.

Cf. *Pecten hallensis*, Wührmann, 1889, p. 203, pl. vi. figs. 12 & 13.

A number of specimens occur of a smooth species of *Pecten* of the *discites* group. The characteristic shell-structure of the group is shown. Numerous fibrous, dichotomous, closely-set threads radiate outwards from the umbo. In uneroded specimens these are only visible in the vicinity of the margins of the valves, but erosion makes the structure apparent over the whole surface. The interior aspect of the valves also reveals the same structure. Concentric accentuations of growth-stages complete the ornamentation.

Owing to the fact that no well-preserved interior is accessible for observation, the characteristic internal ribbing of the group cannot be directly observed. Externally, however, two grooves are seen to radiate from the umbo, making a small angle with the upper margins of the disc. These mark the positions of the internal ribs.

The specimens are large (up to 5 cm. in diameter). The ears do not project above the umbo. The general shape and proportions agree very well with those of the specimen of *hallensis* figured by Wührmann in his plate vi. fig. 12. Although occasional specimens of *P. discites* attain this size,

the species is usually much smaller. The Raibl specimens of *P. hallensis* average, however, much the same size. In the outline of their discs both species vary from circular to the subquadrate form of the above-cited figure of Wöhrmann's. *P. hallensis* differs from *discites* only by possessing a nodular swelling at the extremity of its internal ribs, a distinction probably of not more than varietal significance.

The shell-structure of the group is particularly interesting. The striæ radiate outwards so as always to be normal to the shell-margin where they meet it. In this respect they are analogous to the radiating punctate grooves of the Middle Jurassic species *P. lens*, a type of ornamentation which is met with in various *Pecten* species up to the present day*. But the analogy ends here, for the particular type of shell-structure shown by the present specimens is restricted to the Triassic *discites*-group, and is a fundamental feature of the building-up of the internal shell-layers. A section parallel to the surface of the shell, viewed under the microscope, discloses a system of acutely wedge-shaped, interlocking crystals of calcite.

The structure is not visible externally in many specimens of *P. discites*. For this reason specimens in which it is apparent were distinguished by Goldfuss as *P. tenuistriatus*. Hauer, meeting with the same structure in Alpine specimens, gave them the name of *P. filusus*†, considering it a sufficient basis for specific distinction. Subsequent authors have referred to it as the "*filusus*-structure." It appears that in small and uneroded specimens it is not visible externally; in larger specimens it becomes apparent in the neighbourhood of the margin, while in all cases it is revealed by erosion of the outer shell-layer.

The majority of German authors have referred the species of this group to the subgenus *Entolium*, which Woods has shown should probably be considered identical with *Syn-cyclonema*. The present Triassic group is so peculiar that a distinct subgeneric name might be more appropriate.

Localities.—W. Hesban (L. 33322-5); W. Ayun Musa (L. 33326).

* See Philippi, Zeitschr. Deutsch. Geol. Ges. lii. 1900, pp. 89-91.

† 'Fauna der Raibler Schichten,' 1857, p. 30, pl. vi. figs. 13-16.

Family Limidæ.

Genus LIMA, Bruguière, 1792.

Lima lineata, Schlotheim, sp. (Pl. II. fig. 1.)

Chamites lineatus, Schlotheim, 1820, p. 213; 1823, p. 110, pl. xxxv. fig. 1.

Lima lineata, Goldfuss; Giebel, 1856, p. 26, pl. vi. fig. 11.

L. striata, var. *lineata*, Eck; Assmann, 1916, p. 601, pl. xxxii. fig. 3.

This species is represented by one left valve. This is ornamented anteriorly and posteriorly with rounded radial ribs, separated by narrow grooves. The ribbing is almost obsolete on the central portion of the shell, but the system of narrow grooving radiating from the umbo is here discernible. As in the typical species of the subgenus *Plagiostoma*, the shell is most elongated anteriorly. Thus the longest line that can be drawn from the umbo to the opposite margin is only slightly longer than the angulation which cuts off the anterior portion of the shell. This angulation is straight and fairly sharp; beyond it, the shell is excavated to form a fairly long pseudo-lunule. The anterior wing does not project sufficiently to be visible in the front aspect of the valve. The shell is only moderately inflated; the umbonal angle is slightly greater than 90°.

The hinge-structure of this valve may be fairly well seen. On the ligament-area below the umbo a deep triangular ligamental groove is seen to run in an oblique posterior direction. This corresponds very well to the figures given by Giebel (1856, pl. vi. figs. 11 *a*, *b*) of the right valve.

Dimensions.—Length ca. 35 mm.; height ca. 50 mm.

It has been pointed out by Bittner (1895, p. 188) and Philippi* that this group of *Lima* is allied very closely to the genus *Mysidioptera*, by reason of the position of the ligamental groove. On the other hand, the anterior elongation and the long sharp anterior angulation are features associated more with the *Lima* subgenus *Plagiostoma*, so that the group occupies an intermediate position between the two genera.

Locality.—Wadi Hesban (L. 33330).

Previous Records.—German Trias, Muschelkalk and Grenz-dolomit. Marine Trias, Alpine Muschelkalk. Not definitely known from higher horizons, but compare *Plagiostoma*

* Zeitschr. Deutsch. Geol. Ges. lii, 1900, pp. 621, 624.

? *mezzovallense*, Bubnoff (1921, p. 301, pl. i. fig. 17), and *P. spitzbergense*, Lundgr., Bubnoff (1921, p. 304), both from beds of Ladinic age.

Lima costata, Münster.

Lima costata, Münster; Goldfuss, 1836, p. 79, pl. c. fig. 2.

Lima costata, Goldfuss; Tornquist, 1900, Zeitschr. Deutsch. Geol. Ges. lii. p. 136, pl. iii. fig. 4.

Lima costata, Goldfuss; Assmann, 1916, p. 601, pl. xxxii. figs. 4 & 5.

Several specimens, all somewhat broken. Ornamented by about 16 fairly acute radiating ribs, separated by interspaces the same width as, or slightly wider than, themselves. Similar to the last species in their anterior elongation and their sharp anterior angulation, beyond which lies an elongated pseudo-lunule. The height of the largest is about 4 cm.

The acuteness of the ribbing of the best-preserved specimen indicates the reference to *L. costata* rather than to *L. striata* (Schlotheim). In a second specimen the ribs are more rounded and less prominent. For this reason this latter specimen might rather be referable to *L. striata*. It seems very doubtful whether any constant distinction can be drawn between these two species.

Locality.—Wadi Hesban (L. 33327-9).

Previous Records.—German Muschelkalk. Alpine Muschelkalk and Schlern Dolomite (Ladinic).

Genus *MYSIDIOPTERA*, Salomon, 1895.

Mysidioptera cf. *vir-costata*, Stoppani, sp.
(Pl. II. figs. 2 a, b.)

Cf. *Lima vir-costata*, Stoppani, 1860, p. 97, pl. xix. fig. 16.

Cf. *Mysidioptera vir-costata* (Stopp.); Bittner, 1895, p. 180, pl. xx. figs. 24-28.

Cf. *Mysidioptera vir-costata* (Stopp.); Tommasi, 1911, Pal. Ital. xvii. p. 27, pl. iii. fig. 1.

Cf. *Mysidioptera incurrostriata* (Gümb.-Wöhrm.); Broili, 1904, Palaeontographica, l. p. 180, pl. xx. figs. 17, 18.

One specimen occurs which is probably to be referred to this species. Its general contour is rounded-trapezoidal, and the longest line that can be drawn from the umbo to the opposite margin makes an angle of about 40° with the anterior margin. The latter is straight only for a short distance, and then curves gradually round to form the ventral margin. The anterior angulation extending from the umbo is sharp, but cuts off from view only the extreme upper

portion of the anterior margin. The pseudo-lunule so formed is deep, but necessarily short; the anterior border of the cardinal area meets the anterior margin of the shell in a simple obtuse angle. There is no such acute indentation as is figured by Bittner (*loc. cit.* fig. 26). On the cardinal area a wide, and only slightly oblique, ligament-pit runs posteriorly from the umbo. The posterior portion of this area has, unfortunately, been destroyed.

The surface-ornamentation recalls that of *Lima lineata*, radial threads occurring on the extreme anterior and posterior sides and the centre of the shell being unornamented.

Dimensions.—Length ca. 40, mm.; height ca. 55 mm.

From most of the above-cited figures of the species the present specimen differs in the straightness of its anterior margin, which is usually somewhat outcurved. Tommasi's figure is, however, very similar. The absence of the pronounced anterior elongation associated with the species of *Lima* just described serves readily to distinguish the present form and to indicate its reference to the genus *Mysidioptera*.

It seems probable that a similar relationship exists between *M. via-costata* and the radially ribbed *M. incurvostrata* as exists between *L. striata* and *L. lineata*. The specimen figured by Broili as *incurvostrata* seems in its ornamentation and shape to be referable rather to *via-costata*.

Locality.—W. Hesban (L. 33331).

Previous Records.—Ladinic and Carnic stages of Alpine Trias.

Family Mytilidæ.

Genus MYALINA, de Koninck, 1842.

Myalina tommasii, Salomon, var. *obtusa*, Salomon.

(Pl. I. figs. 17 a, b.)

Myalina tommasii, var. *obtusa*, Salomon, 1895, p. 157, pl. v. fig. 25.

Myalina tommasii, var. *obtusa*, Sal.; Wilckens, 1909, p. 148, pl. v. fig. 26.

Cf. *Myalina* aff. *tommasii*, Sal.: Bittner, 1895, p. 199, pl. xxiv. fig. 28.

Represented by one right valve, preserved in soft yellow marl, allowing the hinge-structure to be prepared for observation.

The general broadness of the outline of this variety, accompanied by the comparatively large apical angle, serves to distinguish it from the typical *tommasii*. Beneath the umbo the anterior margin is incurved to a very marked

degree. The hinge-margin is moderately thick, and forms a very acute angle with the portion of the anterior margin above the incurvation. The angle between the two margins is here filled up by a strengthening plate level with the margins. The ligamental area has two or three longitudinal grooves, and this grooving appears to extend also on to the plate occupying the umbonal angle. Such longitudinal grooving is characteristic of the genus *Myalina*, the typical Devonian and Carboniferous species of which have, however, much wider ligamental areas.

Dimensions.—Length 17·5 mm. ; height 22 mm.

With regard to the determination of the specimen, it must be mentioned that the hinge-structure of *tommasii* has hitherto been only imperfectly known. No trace of the longitudinal grooving could be observed by Salomon, while in the fragment figured by Bittner it is only faintly indicated. The degree of incurvation of the anterior margin and the infilling of the umbonal angle are also more pronounced than in the specimens figured by these authors.

It is possible that *M. tommasii* should be considered identical with the well-known species *Myalina eduliformis* (Schloth.) = *M. vetusta* (Goldf.) from the German Trias. It has been pointed out by Benecke* and Frech† that in the Lower Muschelkalk this species is represented by broad specimens with comparatively blunt apical angles, while at higher horizons specimens predominate very narrow in form with acute apical angles. As the latter form is that of Schlotheim's type, Frech proposed to distinguish the former as "*mut.*" *præcursor*. But the broader form has been recorded from a horizon as high as the Grenz dolomit of the Keuper. Varieties of *M. eduliformis* resemble very closely Salomon's *M. tommasii*, and some of the broader forms (e. g., *Mytilus vetustus*, Goldf., Benecke‡) show an approach to his var. *obtusum*, but none are quite as broad.

The figures given by Benecke (1905, p. 707) of the interior of the valves of *eduliformis* agree very well with this aspect of the Palestine specimen, except that Benecke could observe no longitudinal striation of the ligamental area. Such striation has, however, been figured by Frech (1904, p. 21).

Locality.—Wadi Hesban (L. 33332).

Previous Records (of *tommasii obtusum*).—Ladinian Stage of Alpine Trias.

* Centralbl. Min. 1905, p. 705.

† Res. Wiss. Erf. Balatonsees, Pal. Bd. ii. Heft 2, 1904, p. 20.

‡ Geogn.-Pal. Beiträge, ii. 1868, pl. 1. figs. 8, 17.

Genus MYTILUS, Linné, 1758.

Mytilus [*Myalina*?] sp. (Pl. I. fig. 18.)

This small mytiliform shell closely resembles specimens of the German Muschelkalk species of *M. eduliformis* intermediate between the typical form and Frech's "mut." *præcursor* (see above). As its external form only can be examined, it is impossible to decide whether it is a true *Mytilus*. From such species as *Mytilus vomer*, Stoppani, and *Mytilus præacutiformis*, Wilckens, from the Ladinic stage of the Alpine Trias, it differs in the relatively large angle made by its long axis with the short cardinal margin.

Dimensions.—Length 11 mm.; height 12·5 mm.

Locality.—Wadi Ayun Musa (L. 33333).

Genus VOLSELLA, Scopoli, 1777.

[*Modiolus*, Lamarck, 1799.]

Volsella cf. *paronai*, Bittner, sp.

Cf. *Modiola paronai*, Bittner, 1895, p. 48, pl. v. figs. 19–20.

Cf. *Modiola paronai*, Bittn.; Scalia, 1912, p. 24, pl. ii. figs. 31–38.

Two eroded casts, the smaller agreeing very closely with the specimen figured by Bittner (fig. 20).

Dimensions.—Larger specimen: length 13·5 mm.; height 9·4 mm.

Locality.—Wadi Hesban (L. 33334).

Previous Records.—Upper Trias of Lombardy and Sicily.

Family CARDINIIDÆ.

Genus ANODONTOPHORA, Cossmann, 1897.

[For *Anoplophora*, Sandberger, 1862, non Hoops, 1840.]

Anodontophora münsteri, Wissmann, sp. (Pl. II. figs. 7–8.)

Unionites münsteri, Wissmann; Münster, 1841, p. 20, pl. xvi. fig. 5.

Anoplophora münsteri (Wissm.); Bittner, 1895, p. 9, pl. i. figs. 22 & 23.

Anoplophora münsteri (Wissm.); Galdieri, 1908, p. 96, pl. ii. fig. 24 (with synonymy).

Cf. *Anodontu lettica*, Quenstedt, 1852, Handb. Petr. 1st ed., p. 529, pl. xlv. fig. 16.

Cf. *Anoplophora lettica* (Quenst.); Grupe, 1907, v. Koenen Festschrift, p. 118, pl. iv. figs. 6 & 7 (with synonymy).

Cf. *Anoplophora donaciformis*, Scalia, 1912, p. 40, pl. iii. fig. 22.

This species is represented by several specimens, internal casts with the remains of the original shell adhering in places.

The contour is elongate-oval, the umbones being non-salient. The relative proportion of length to height varies. On one cast (L. 33337) the characteristic deep curved depression below the umbo indicates the position of the posterior border of the anterior muscle-scar. There is no pronounced carination extending in a postero-ventral direction from the umbo.

Dimensions.—Largest specimen: height 12.5 mm.; length 29.3 mm.

Locality.—Wadi Hesban (L. 33335-8).

Previous Records.—*A. münsteri* is widely distributed in the marine Upper Trias of Europe, the actual type-specimen coming from the Carnic Heiligkreuz Beds of St. Cassian. It has also been recorded by Tommasi from the Muschelkalk and Lower Trias of Lombardy, but one must doubt the correctness of his determination. *A. münsteri* is very closely related to, if not identical with, *A. lettica* from the German Lettenkohle. The variations in form of this latter species have been described by Zeller (1907, p. 42; 1907 a, p. 78), who regards *münsteri* as a variety of *lettica*. Priority of nomenclature would, in any case, require this relationship to be reversed.

Anodontophora münsteri, Wissmann, sp., var.
(Pl. II. fig. 9.)

Cf. *Myacites letticus* (Quenst.); v. Schauroth, 1857, p. 117, pl. vi. fig. 14.
Cf. *Anoplophora lettica* (Quenst.), vars. *crassa* and *ovalis*, Zeller, 1907, p. 43.

Cf. *Anoplophora aciteddai*, Scalia, 1912, p. 39, pl. iii. fig. 19.

In addition to those specimens which are referable to the typical form of *A. münsteri*, two occur which are much more rounded in contour, but which, in view of the variation shown by species of this group, are probably only to be considered as a varietal form of *münsteri*. The contour is an unbroken oval, the umbones being non-salient. About a quarter of the total length of the shell lies in front of the umbones. The proportion of length to height is 1.75 to 1. In the majority of described species of the genus with similar proportions, there is at least an embayment of the shell-contour anterior to the umbones, and usually the latter are salient above the cardinal margin. The degree of inflation is small and there is no carination.

Dimensions.—Larger specimen: height 13.7 mm.; length 23.6 mm.

Of the varieties of *lettica* proposed by Zeller, vars. *crassa*

and *ovalis* appear from his description to show the closest approach to the present form. The former, however, appears to be more inflated, the latter more triangular in form. Scalia's *A. aciteddai* is very closely comparable, and probably bears the same relationship to his *A. donaciformis* as the variety now described to that which I have identified with the typical *A. münsteri*.

Locality.—Wadi Hesban (L. 33339–40).

Family Modiolopsidæ.

Genus MYOCONCHA, J. Sowerby, 1824.

Myoconcha aff. *goldfussi* (Dunker), Eck. (Pl. II. fig. 10.)

? *Modiola goldfussi*, Dunker, 1849, Kasseler Schulprogramm, p. 11.

Myoconcha goldfussi (Dunk.); Eck, 1872, Abh. geol. Spezialk. Preussen, Bd. i. p. 90, pl., fig. 6.

Myoconcha goldfussi (Dunk.); Philippi, 1903, Leth. Geogn., Trias, pl. v. fig. 5.

Cf. *Myoconcha bassanii*, Tommasi, 1890, p. 31, pl. ii. figs. 8–9.

Cf. *Pleurophorus* aff. *elongatus*, Moore, Scalia, 1912, p. 40, pl. iii. figs. 25–27, 31–34.

An internal cast, with a small portion of original shell adhering in one place. Shell moderately inflated; elongate, with height increasing posteriorly; projecting anteriorly to umbo. Cardinal margin straight. Posterior margin slightly convex, its general direction forming an obtuse angle with cardinal margin and an acute angle with ventral margin. Ventral margin with an embayment, corresponding to a shallow depression running ventrally and posteriorly from the umbo. An obtuse carina runs from the umbo to the postero-ventral angle. There is no trace of any additional carina between the cardinal margin and the major carina. Such a carina on the shell might not be visible on the internal cast. A second specimen (L. 33342), much smaller, and probably a juvenile form of the same species, possesses a second carina about half-way between the major carina and the margin.

Dimensions.—Larger specimen: length 33 mm.; height 16.5 mm.

The German Muschelkalk species of the group to which *goldfussi* belongs vary in the following characters:—(a) general outline triangular to rectangular, (b) cardinal margin straight to slightly convex, (c) ventral margin embayed or unembayed, (d) umbo terminal or not, (e) major carina well or poorly defined, (f) second carina present or absent. Eck attempted to define four species (*goldfussi*, *gastrochaena*, *thielaii*, and *roemeri*), while Assmann has further increased

the number. All possible intermediate forms appear, however, to occur. This group ranges in the German Trias from the Lower Muschelkalk to the Lettenkhole; also in the Anisic deposits of the Alpine Trias.

The present species agrees closely with Eck's interpretation of *goldfussi*. It is relatively somewhat wider anteriorly.

Of species from the higher horizons of the marine Trias, Tommasi's *M. bassanii* from the Raibl Beds is undoubtedly closely allied to the present species. The general similarity in size and form to *Modiolopsis gonoides*, Healy, a species apparently widely distributed in the Upper Trias of S.E. Asia, is also very pronounced. Healy, from an examination of the internal cast, concluded that her species was edentulous. It is interesting, therefore, to observe that similar statements have been made by various authors with reference to the *goldfussi* group of Muschelkalk species (*cf.* Giebel, 1856, p. 35).

Localities.—Wadi Hesban (L. 33341); Wadi Ayun Musa (a juvenile) (L. 33342).

Family Pleurophoridae.

Genus *TRAPEZIUM*, Megerle, 1811.

[*Cypricardia*, Lamarck, 1819.]

Trapezium (?) sp. (Pl. II. fig. 13.)

Of. Cypricardia escheri, Gieb.; Assmann, 1916, p. 629, pl. xxxvi. figs. 1-2.

A cast weathered out on a hard sandstone surface. The general form of the shell is the only indication of its affinities. Rounded-triangular, umbo anteriorly situated. An obtuse carina descends from the umbo to the posterior ventral corner of the shell. The proportions agree closely with that of the Jurassic species of *Pseudotrapezium* and with Assmann's figure of *escheri*. The latter is, however, slightly more elongate, and falls away more rapidly posteriorly to the carination.

Certain species of *Myophoria* (e. g., *kefersteini*, Münster) show a close approach to this form of shell. In the present specimen, there is, however, no trace of any radial ribbing in addition to the carination, which is also much blunter than in any similar species of *Myophoria*.

Locality.—Wadi Ayun Musa (L. 33343).

Family Trigoniidæ.

Genus MYOPHORIA, Broun, 1835.

Myophoria lævigata, Goldfuss, sp.

Trigonia lævigata, Goldfuss; Zieten, 1833, p. 94, pl. lxxi. fig. 2.

Myophoria lævigata, v. Alb.; Rübenstrunck, 1912, pp. 124-133, pl. vi. figs. 5-9 (with synonymy).

Myophoria lævigata, v. Alb.; Hohenstein, 1913, Pal. Abhandl., n. F., Bd. 12, Heft 2, p. 36, pl. ii. figs. 3-4.

An abundant fossil. Mostly preserved in the form of internal casts, but one specimen, in a soft yellow limestone matrix, has allowed preparation of the hinge. The form is of the typical variety of the species, closely agreeing with the above-quoted figures. The dentition of the right valve is seen to consist of a thick stumpy anterior cardinal and an elongated posterior cardinal, parallel to the hinge-line.

Locality.—Wadi Hesban (L. 33344-8).

Previous Records.—German Trias: abundant from Röt to Keuper Grenzdolomit. Marine Trias: widespread in beds of Werfenian and Anisic age in Europe and Asia. Recorded, in non-typical varieties, from the Ladinic Marmolata Limestone and from the Rhætic of Italy.

Myophoria transversa, Bornemann, sp. (Pl. II. fig. 11)

Lyrodon vulgare, Goldfuss, 1837, p. 198 (pars), pl. cxxxv. fig. 16 c.

Trigonia transversa, Bornemann, 1856, Lettenkohle Thüringens, p. 11, pl. i. figs. 1, 2.

Myophoria transversa (Bornem.); Zeller, 1907 a, p. 91, pl. i. fig. 13, pl. ii. fig. 2.

Myophoria transversa (Bornem.); Rübenstrunck, 1912, pp. 182-186, pl. vii. fig. 15 (with synonymy).

Myophoria vulgaris, var. *transversa* (Bornem.); Assmann, 1916, p. 621, pl. xxxiv. fig. 20.

The three species *M. vulgaris*, *M. transversa*, and *M. intermedia* are distinguished from one another by the relative width of the furrow extending from the umbo to the posterior portion of the ventral margin. Posteriorly this furrow is bordered by the "areal carina," which cuts off the posterior area of the shell, and anteriorly by the "extra-areal rib" (see descriptive terms introduced by Rübenstrunck, 1912, p. 96). A measurement of this furrow is given by "Seebach's ratio," i. e., distance between "areal carina" and "extra-areal rib": length of "areal carina."

Several of the specimens now described are referable to

M. transversa. For these specimens Seebach's ratio is about 1:2, the value accepted for the species. The posterior area of these specimens is very oblique, giving the shell a truncated appearance. On this area a strong rib running from the umbo to the margin cuts off a well-defined escutcheon, while a second, fainter, rib occurs half-way between this and the "areal carina." The shell-surface, anterior to the "extra-areal rib," is ornamented with concentric undulations.

Dimensions.—Largest specimen: length 14 mm.; height 14 mm.

Locality.—W. Ayun Musa (L. 33350-3).

Previous Records.—Hitherto only known from German Trias. Most abundant in Lettenkohle and Keuper. Rare in Röt and Muschelkalk.

Myophoria intermedia, v. Schauroth.

Lyrodon curvirostre, Goldfuss, 1837, p. 198 (pars), pl. cxxxv. figs. 15 c, d (non Schlotheim).

Myophoria intermedia, v. Schauroth, 1857, p. 127, pl. vii. fig. 3.

Myophoria intermedia, v. Schaur.; Itzenstrunck, 1912, pp. 186-190, pl. vii. figs. 16-18.

Myophoria intermedia, v. Schaur.; Wurm, 1912, p. 94, pl. vi. figs. 1-3.

Although several specimens of this species were obtained, none is perfectly preserved. For all these specimens Seebach's ratio is about 1:4, the accepted value for the species. The "extra-areal rib" is well developed. The "areal carina" is practically straight, not concave posteriorly, as in *M. elegans*. The concentric undulations ornamenting the surface are not impressed on the internal cast.

Dimensions.—Length ca. 17 mm.; height ca. 13 mm.

Localities.—W. Hesban (L. 33354-9). N.E. shore of Dead Sea, half-way between W. Ayun Musa and W. Ghueir (L. 33360-2).

Previous Records.—German Trias, Lower Muschelkalk to Keuper. Upper Trias of Sicily (?).

It is possible that *M. transversa*, *M. vulgaris*, and *M. intermedia* are to be considered varietal forms of one species. Although intermediate forms occur, Seebach's ratio for the group seems to centre round three definite values, corresponding to these three forms.

Here in Palestine, as in the German Lettenkohle, the two extreme forms are abundant (but each appears from its matrix to occur in a definite bed), while the intermediate

form *M. vulgaris* is absent or rare. Zeller (1907 a, p. 93), dealing with this point, points out that *transversa* appears to occur at horizons where brackish-water conditions are indicated, while *intermedia* occurs at more marine horizons.

Genus MYOPHORICARDIUM, Wöhrmann, 1889.

Myophoricardium lineatum, Wöhrmann (?).

(Pl. II. figs. 3 a, b.)

Myophoricardium lineatum, Wöhrmann, 1889, p. 227, pl. x. figs. 10-14.

Myophoricardium lineatum, Wöhrm.; Bittner, 1895, p. 117, pl. xiii. figs. 18-22.

Myophoricardium lineatum, Wöhrm.; Toulia, 1909, p. 397, pl. xii. fig. 16.

Myophoricardium lineatum, Wöhrm.; Scalia, 1912, p. 51, pl. iii. fig. 64.

It would be of great interest definitely to determine the presence of this typical Raibl species in the fauna now described. The specimen referred with doubt to the species is a right valve somewhat compressed and broken in its postero-ventral corner. A study of Bittner's figures shows that the species is very variable in its general contour, especially in the prominence of the wing-like extensions of the valve each side of the umbo. In the present specimen these extensions are not very prominent. The general outline is sub-circular, the surface smooth, and there is no lunule anteriorly. Posteriorly a carination cuts off a very oblique area, which, although badly eroded, appears to have been ornamented by two very faint radial ribs, one adjacent to the carination and the other half-way between this and the margin. In the Alpine species the posterior area is absolutely smooth and unornamented, and for this reason some doubt arises as to the identity of the present specimen. It may, however, be remarked that in some species of *Myophoria*, the presence of radial ribbing on the posterior area is a very variable factor, and the same may be the case with *Myophoricardium lineatum*.

The dentition of the right valve agrees quite well with that of the Alpine species, as figured by Wöhrmann and Bittner. There is a well-developed triangular cardinal tooth under the umbo, separated from the anterior margin by a deep triangular dental socket. The striation of the walls of this socket, mentioned by Wöhrmann, cannot be observed, but may have been obliterated by erosion. A posterior lateral tooth, beginning not far from the umbo, is also well developed. The ligamental groove is external, running posteriorly from the umbo.

Dimensions.—Length 10 mm.; height 10 mm.

Locality.—Wadi Ayun Musa (L. 33363).

Previous Records.—Raibl Beds of Alpine Trias; Upper Trias of Sicily. A slightly smaller, but otherwise very similar, species, *M. sublineatum*, Krumbeck, from the U. Trias of Sumatra.

Genus *MYOPHORIOPSIS*, Wöhrmann, 1889.

Myophoriopsis jordanensis, sp. n. (Pl. II. figs. 4 a, b, c.)

Diagnosis.—Shell ovoid, length slightly exceeding height. Moderately inflated; greatest inflation just below umbo. Umbo slightly anterior to centre, not prosogyrate. Lunule absent. Oblique posterior area cut off by angulation of shell running from umbo to postero-ventral margin; angulation not sharp and simple, but spread over three carinae, near together and separated by narrow furrows. Escutcheon long and narrow. Posterior area ornamented, between escutcheon and angulation, by two ribs (one very faint) running from umbo to posterior margin. Shell-surface smooth.

Dimensions.—Length 8·7 mm.; height 7·4 mm.

Remarks.—This species is represented by one left valve. The dentition agrees well with that of other species of the genus both from the Alpine Trias (cf. Bittner, 1895, pl. xiii.) and from the German Trias (cf. Hohenstein, 1913, pls. ii.—iii.). A prominent anterior cardinal tooth is separated by a narrow groove from the anterior portion of the hinge-margin. Posterior to this tooth is a triangular depression corresponding to the cardinal tooth of the right valve. Beyond this, in contact with the posterior portion of the hinge-margin, is what appears to be a rudimentary posterior cardinal tooth. The lateral portions of the hinge-margin are broken away, so that the presence of lateral projections of this margin, acting as teeth, cannot be ascertained.

The main distinctive characters of the species are the non-prosogyrate umbo, the absence of lunule, and the plain surface. The German species are, for the most part, relatively more elongated. The proportions are much the same as with the Alpine Raibl species, *M. rosthorni*, but the latter possesses a well-marked lunule and a surface ornamented by strong concentric undulations. The most closely allied species previously described is *M. seranensis*, Krumbeck, from the Upper Trias of Ceram*.

Locality. Wadi Ayun Musa (L. 33365).

* 'Palæontographica,' Suppl. iv. 3rd Abt. 1923, p. 210, pl. xiii. fig. 16, pl. xv. fig. 10.

Family Lucinidæ.

Genus SCHAFHÄUTLIA, Cossmann, 1897.

[For *Gonodon*, Schafhäutl, 1863, non Held, 1837.
Originally misprinted *Schafthautlia*.]

Schafhäutlia astartiformis, Münster, sp.

Isocardia astartiformis, Münster, 1841, p. 87, pl. viii. fig. 24.

Gonodon planum, Salomon, 1895, p. 169, pl. v. figs. 47-49 (non Münster).

Gonodon laubei, Bittner, 1895, p. 14, pl. iii. figs. 5-6.

Represented by one left valve. In its general form and only moderate inflation this closely resembles the above-cited figures of Salomon and Bittner.

Dimensions.—Length 15.4 mm.; height 13.5 mm.

As Bittner himself states, *G. laubei* is scarcely separable from *G. astartiformis*; the identity of Salomon's *G. planum* with this species has been pointed out by several authors.

Locality.—Wadi Hesban (L. 33366).

Previous Records.—Widely distributed in the Ladinic and Carnic stages of the marine Trias of Europe and Asia.

Schafhäutlia subquadrata, Parona, sp.

(Pl. II. figs. 5-6.)

Fimbria (Sphæriola) subquadrata, Parona, 1889, p. 141, pl. xiii. figs. 5 a, b.

Schafhäutlia subquadrata (Par.); Galdieri, 1908, p. 116, pl. iii. fig. 10.

Sphæriola subquadrata, Par.; Koken, 1913, Abh. K. K. g. Reichsanst. xvi. 4, p. 36, pl. iv. fig. 1.

Gonodon meltingi, Hauer; Galdieri, 1905, Atti Accad. Sci. Napoli, (2) xii. p. 12, fig. 12.

Cf. *Gonodon angulatum*, Salomon, 1895, p. 170, pl. v. fig. 48.

Represented by several specimens, mostly eroded casts, but two with the original shell preserved.

Shell considerably inflated; posterior extremity quadrate; umbones relatively anteriorly situated, not salient; growth-stages of shell well marked.

Dimensions.—Largest specimen: length 29.5 mm.; height 22.5 mm.

The species of this genus recorded from the marine Trias are extremely variable, and much divergence in views concerning synonymy has existed among different authors. Of the three groups into which v. Bufoff (1921, pp. 325-334) has divided the genus the present specimens undoubtedly belong to the *subquadrata* group. Of Parona's original figures of the species, fig. 5 a represents a form of abnormal

growth. The normal form is represented by his fig. 5 *b* and Galdieri's figures. In the present specimens the anterior extremity of the shell is relatively somewhat lower, so that the umbones are, from an anterior aspect, more prominent.

In its general outline *S. subquadrata* resembles very closely the species *Unicardium* (*Schafshäutlia*) *schmidt*, which ranges in the German Trias from the base of the Muschelkalk to the Keuper Grenzdolomit. Accounts of the dentition of this species, based chiefly on observation of the internal cast, differ, so that the generic position has been much discussed. The majority of German authors have failed to detect any hinge-teeth, and have advocated its reference to *Unicardium*, but Zeller and others consider it to be a *Schafshäutlia*. Koken, in the above-cited description of *subquadrata*, states that this species appears to be quite edentulous and would be more correctly referred to *Unicardium*. These two species are undoubtedly very closely allied.

Localities.—W. Hesban (L. 33367-72), W. Ayun Musa (L. 33373-4).

Previous Records.—Upper Trias of Tyrol and Italy.

Family Anatinidæ.

Genus BURMESIA, Healey, 1908.

[Healey, *op. cit.* p. 56; Krumbeck, *Palæontographica*, Supp. iv. Abt. ii. Lief. i. 1913, p. 75; Mansuy, *Mém. Surv. Géol. Indochine*, vol. iii. fasc. ii. 1914, p. 23.]

This genus was founded on two species, *B. latouchi* and *B. livata*, from the Rhætic of Upper Burma; a third species, *B. præcursor*, has since been described by Krumbeck from the Upper Trias of the E. Indies. *B. livata* has been met with again in this latter locality, and has also been figured by Mansuy from the Rhætic of Tonkin. These species have been known only in the form of casts, which have afforded detailed information as to the surface-ornamentation, but no accurate knowledge of the hinge-structure. The generic characters may be summarised as follows:—

Shell elongate-oval, moderately inflated, gaping posteriorly. Umbo almost central (slightly anterior), inconspicuous, posteriorly directed. Hinge-margin long and straight. Hinge apparently edentulous. Chondrophore present. Surface-ornamentation elaborate, a combination of radial ribbing with concentric undulations. Radial ribbing most conspicuously developed on central portion of shell, where it predominates over concentric ornamentation.

In *B. latouchei* this ribbing extends on to the anterior portion of the shell, but is here subordinate to the concentric ornamentation. A peculiar trellis-like system is thus developed. In *B. lirata* and *B. præcursor* an oblique system of ribbing occurs anteriorly instead. Posteriorly the concentric type of ornamentation predominates. Radial ribbing is here completely absent in *B. lirata* and *B. præcursor*, and very faintly indicated in *B. latouchei*. In all these species the transition from the anterior region to the central region is well defined.

Burmesia ? *posteroradiata*, sp. n.
(Pl. II. figs. 12 a, b, c.)

The generic affinities of this species being uncertain, the following diagnosis is independent of the generic diagnosis of *Burmesia*.

Diagnosis.—Shell elongate-oval, tapering posteriorly, rounded anteriorly. Length:height = 1·7:1. Umbo slightly anterior to centre of shell, directed posteriorly, rising prominently above posterior portion of hinge-margin. Hinge-margin straight, about $\frac{1}{4}$ of length of shell, and forming a wing posteriorly. Inflation of shell only slight. Shell-surface divisible into two areas by a line drawn from umbo in a ventral and slightly anterior direction. Anterior area ornamented by strong concentric undulations, crossed by numerous fine radial ribs. Posterior area ornamented by fourteen prominent sharp radial ribs, most closely packed on central portion of shell, but extending on to posterior wing. Concentric ornamentation inconspicuously developed on posterior area.

Dimensions.—Length ca. 28 mm.; height ca. 17·5 mm.

Remarks.—This species is represented by two left valves, one of which adheres to the exterior of the other in such a manner as to obscure all the surface of the lower one, with the exception of that portion in the neighbourhood of the umbo and the anterior margin. These two valves must be regarded as the syntypes, knowledge of the surface-ornamentation of the species being derived mainly from the upper one and of the contour of the shell from the lower one; the margin of the upper one is not completely preserved. The finer details of surface-ornamentation have been somewhat obliterated by erosion, and the details of the hinge-structure have been destroyed. The matrix is a hard grey limestone, differing from that of most of the fossils.

The general contour and only moderate inflation of the

species indicate its affinities to the family Anatinidæ, but its exact generic position is more difficult to decide. The surface-ornamentation is a very distinctive feature, the intense radial ribbing on the posterior portion of the shell being unique. Feebly developed posterior radial ornamentation is met with in certain Upper Jurassic species of *Anatina* and in the genus *Anatimya*, Conrad, from the Cretaceous of N. America, but from such forms the present species is quite distinct. At first sight there is also some resemblance to the genus *Pholadomya*. In this genus, the central inflated portion of the shell is ornamented by radial costæ of varying intensity, crossed by concentric undulations. These costæ may extend on to the posterior portion of the shell, but are never sharp and well developed here. Moreover, the almost central position of the umbo and the small degree of inflation of the present species preclude reference to this genus.

In general shape and inflation, in the marked difference between the surface-ornamentation of the anterior portion and of the remainder of the shell-surface, in the fine trellis-like character of this surface-ornamentation, particularly on the anterior area near the umbo, and in the predominance of radial ribbing on the central portion of the shell, this species resembles previously-known species of the genus *Burmesia*, and from these it is distinguished by the strong posterior radial ornamentation. Thus, although its hinge-structure is unknown, it seems to be most appropriately referable to this genus.

Locality.—Wadi Ayun Musa (L. 33375).

GASTROPODA.

The remains of several species of Gastropoda occur, but these are all too eroded or otherwise damaged for accurate determination.

Genus *NATICA*, Scopoli, 1777.

“*Natica*” sp.

Two specimens of the yellow limestone are crowded with internal casts of a small naticoid shell. The largest individuals attain a height of 6 mm., and consist of three to four moderately convex whorls, rising in step-like manner above one another. The last whorl occupies about three-fifths of the total height of the shell.

This mode of occurrence suggests “*Natica*” *gregaria*

(Schlotheim), which occurs in millions of individuals in certain beds of the Lower German Muschelkalk. In the present specimens the final whorl is relatively much shorter and more convex. That this gregarious habit is met with in the case of small naticoid shells occurring in shallow-water deposits at other horizons also is illustrated, for example, by the similar occurrence of vast numbers of "*Natica*" *oppeli*, Moore, in some beds of the Rhaetic series in Glamorganshire.

Locality.—Wadi Hesban (G. 32500-1).

Genus OMPHALOPTYCHA, v. Ammon, 1878.

Omphaloptycha ? sp. (Pl. II. fig. 14.)

This specimen is so badly eroded that the sutures have been almost obliterated, and even precise generic determination is not possible. The original shell appears to have been replaced by a greatly thickened shell of a secondary character.

The aperture is small, acutely angular posteriorly, and rounded anteriorly. At first sight, an anterior notch in the peristome seems to indicate a short narrow anterior canal, but this may be due to imperfect preservation. There is no trace of any umbilical opening in the base, but this, again, may have been obliterated. The base is not delimited from the flanks of the shell by any sharp angulation.

This does not appear to be identical with any species known from the German and Alpine Trias, but recalls such species as *Omphaloptycha escheri** (Hoernes) and *O. irritata* (Kittl)†. From these it differs mainly in its shorter aperture.

Locality.—Wadi Hesban (G. 32502).

Other Gastropod Remains.

(a) Pl. II. fig. 15. The last two whorls of a steeply wound shell. The whorls are smooth, convex, sub-angular above the anterior suture, which is not deeply impressed. The aperture is short, rounded anteriorly. The presence of an umbilicus is doubtful, but a narrow one may occur. The steepness of the coiling and other characters suggest that this may be a representative of the genus *Spirostylus*, Kittl.

Locality.—Wadi Hesban (G. 32503).

* Figured Kittl, Ann. Nat. Hof.-Mus. Wien, xiv. 1899, pl. xiii. figs. 8-20.

† Jahrb. K. K. geol. Reichsanst. xlv. 1894, pl. v. figs. 15-19.

(b) Two whorls of a much larger specimen, of about the same proportions. Height of larger whorl 12 mm. The specimen is broken off both anteriorly and posteriorly. The winding is steep, not quite to the extent of that of the last specimen. The whorls are smooth, convex, sub-angular above the suture. The species is probably referable either to *Spirostylus* or to *Loxonema* (*Polygyrina*).

Locality.—Wadi Hesban (G. 32504).

CEPHALOPODA.

Genus *PLEURONAUTILUS*, Mojsisovics, 1882.

Pleuronautilus sp.

Two fragments of the outer whorl. The most important characters are a very open umbilicus and a costate ornamentation of the whorl, both features associated with this genus.

Locality.—Wadi Ayun Musa (C. 25230).

Two Ammonoid Fragments. (Pl. II. figs. 16 a, b.)

Dr. L. F. Spath, who has kindly examined these, reports as follows:—"The two fragments may belong to a new species of *Beneckeia*, and differ from the similarly oxynote *B. buchei* (Dunker) chiefly in the external lobes and saddles. The peculiar shape of the external part of the suture-line rather suggests comparison with some Cretaceous *Pseudoceratites* (e. g., *Neolobites*), but since the specimens are fragmentary and weathered, and associated with Triassic fossils, reference to the Triassic *Beneckeia* seems more appropriate."

With reference to Dr. Spath's suggestion that this may be a new species of Cretaceous age, the collector of the specimens assured me that the conditions under which they were obtained precluded any possibility of their derivation from Cretaceous exposures in the neighbourhood. Moreover, such matrix as adheres to them is the yellowish calcareous marl in which the other Triassic fossils are preserved.

The genus *Beneckeia* has hitherto only been recorded from the Lower German Muschelkalk * and from the Lower

* See R. Wagner, Zeitschr. Deutsch. Geol. Ges. xl. 1888, p. 24-35, F. Frech, Lethæa Geogn., Trias, 1903, p. 55, pl. i. fig. 6, and K. v. Fritsch, Abh. Naturf. Ges. Halle, xxiv. 1902, pp. 37-63.

Trias of China*. Its occurrence in a deposit of Upper Triassic age would be highly improbable. For this reason a figure is given of the better-preserved Palestine specimen, for comparison with those of the German Muschelkalk species *B. buchi* and *B. tenuis* given in the works cited. In the present specimen, as with typical species of *Beneckeia*, there is no trace of any denticulation of the lobes; it is, however, difficult to tell to what extent erosion has obliterated the details.

It can be readily seen that the suture differs in some important respects from those of the Lower Muschelkalk species. Without knowledge of the sutures of the earlier whorls it is impossible to decide definitely whether the reference to *Beneckeia* is correct. Until more material is available, the question of the generic affinities of these specimens must be left open.

Locality.—Wadi Ayun Musa (C. 25231-2).

REPTILIA.

Genus NOTHOSAURUS, Münster, 1834.

Nothosaurus sp.

The following is the account, kindly given to me by Dr. C. W. Andrews, of this interesting specimen. Its recognition was the first evidence of the Triassic age of the fauna.

The right humerus of a species of Nothosaur, a bone so characteristic in its form that there can be no mistake about its determination. It is no doubt from beds of Triassic age, probably from the Muschelkalk.

The bone, which is nearly complete, was broken into halves. It very closely resembles a right humerus of *Nothosaurus* from the Muschelkalk of Baireuth preserved in the British Museum (No. 1083 b). The two ends of the bone are thickened and massive, while the shaft, which is triangular in section, is comparatively thin. The deltopectoral crest is not very prominent, but the ridge beneath the processus medialis, on which, according to Fürbringer, the latissimus dorsi muscle was inserted, is strongly developed. The entepicondylar foramen is present. Both ends of the bone seem to have been capped with cartilage.

* F. Frech, in Richthofen, 'China,' Bd. v. 1911, p. 212.

The dimensions of the bone (in millimetres) are :—

Length	267
Greatest width of upper end	64
" " middle of shaft	50
" " lower end of shaft.....	78

Locality.—Wadi Ayun Musa.

AGE OF THE FAUNA.

With two exceptions, all the fossils which have just been described were obtained from the upper 60' of the sequence referred to in the introduction, namely, the yellow calcareous marl with its interbedded bands of limestone.

The only fossils described from a lower horizon are the specimens of *Lingula* cf. *tenuissima zenkeri* and *Trapezium*? sp. from the yellow sandstone underlying the limestone series. The faunal evidence is insufficient to assign any definite age to this sandstone, but from its occurrence its age must almost certainly be Triassic.

A study of the fauna described from the upper portion of the sequence discloses the fact that, apart from the new species, the fossils separate themselves naturally into two groups :—

I. Species which are characteristic of the Raibl Beds of the marine Mediterranean Trias, but unknown from any horizon of the German Trias :—

Ostrea montis caprilis Klipst.

Plicatula (*Pseudoplacunopsis*) *fissistriata* (Winkler).

Anodontophora münsteri (Wissmann) (but cf. *A. lettica*).

Myophoricardium lineatum Wöhrmann (?).

Schafhäutlia subquadrata (Parona) (but cf. *S. schmidi*).

On the evidence of this association of species, one would unhesitatingly assign a Raibl age to the deposit. *O. montis caprilis*, though unknown from the German Trias, has been recorded by Pervinquière* from Dj. Lorbeus, Tunis, a district in which the facies is, on the whole, analogous to that of the German basin. On the evidence of this occurrence Pervinquière assumed the horizon to be the equivalent of the German Lettenkohle. The species *Myophoria transversa* (Bornemann) is a typical Lettenkohle form.

In addition, the new species assigned to the genera *Reubenia* and *Myophoriopsis* have their nearest relatives in Upper Triassic forms.

* Carte géol. Tunisie, 1903, p. 21.

II. Species which, in regions where the Triassic sequence is similar to that found in Germany, occur at any horizon from the Lower Muschelkalk to the Lettenkohle :—

Lima costata, Münster.

Lima lineata (Schlotheim).

Pecten inæquistriatus, Münster.

Pecten discites (Schlotheim).

Myophoria lævigata (Goldfuss).

Myophoria intermedia, v. Schauroth.

Myoconcha goldfussi, Eck.

Cænothyris vulgaris (Schlotheim).

Outside such regions, with the exceptions discussed in the preceding pages, these species are known only from beds of Lower Triassic (Werfenian) or Lower-Middle Triassic (Anisic) age. Such an assemblage, if found outside such a region, would be regarded as definitely indicative of a Muschelkalk (Anisic) age.

The small vertical extent of the fossiliferous beds collected from and the apparent complete conformity of the sequence would gainsay any theory that fossils from deposits of two widely different ages have been mingled, and, moreover, a careful study of the preservation of the different specimens discloses the fact that the same matrix encloses fossils of both groups. Thus specimens of *Lima costata*, *L. striata*, *Myophoria lævigata*, and *Cænothyris vulgaris* are preserved in a soft yellow matrix similar to that yielding *Ostrea montis caprilis*, *Myophoricardium lineatum*, *Plicatula fissistriata*, *Schafhäutlia subquadrata*, and *Myalina tommasii obtusa*.

A harder yellowish-brown matrix contains *Cænothyris vulgaris*, *Anodontophora münsteri*, *Myoconcha* aff. *goldfussi*, *Schafhäutlia astartiformis*, and *Myophoria intermedia*.

Thus the evidence is that all the fossils are derived from a deposit of which the age has not a wide range. The presence of the first group of species is sufficient to indicate that a Carnic age must be assigned to it. This is the age of the Alpine Raibl Beds and of the German Lettenkohle.

FACIES.

If this conclusion be correct, it follows that beds of exactly equivalent facies have not previously been met with in the Mediterranean area at this horizon.

It is now believed that the various marine Triassic deposits of Southern Europe were found in the western half of the Tethys, a much enlarged Mediterranean Ocean which

stretched far to the east across the Himalayan area. Communicating with this were two land-locked seas, occupying respectively the areas of development of the German Trias and the analogous Iberian-N.W. African Trias*.

It has long been known that the lamellibranch and brachiopod fauna of the Anisic deposits of the Alpine area consists largely of the same species as are found in the German area at the same (Muschelkalk) period. But, whereas in this latter area the same species are met with at all marine horizons, even as high as that of the Grenzdolomit at the top of the Lettenkohle, in the Alpine area these species are mostly of extremely rare occurrence above the Alpine Muschelkalk horizon.

As it must be assumed that the sea which flooded the German basin in Hauptdolomit and Grenzdolomit times communicated to some extent with the Tethys, it is very remarkable that none of the new forms which had come into existence in the Mediterranean area (true oysters, for example) found their way into the German basin. Thus not one of the typical Raibl species is known from the Grenzdolomit.

It is also very remarkable that species like *Myophoria laevigata*, which had an almost world-wide distribution in Werfenian and Anisic times, became, as far as existing records inform us, subsequently restricted to the German basin.

Although much has been written about the variations in Triassic faunas as influenced by difference in facies, no satisfactory explanation has yet been afforded of the reasons for these remarkable differences in fauna between the two areas in the marine deposits of Ladinic and Carnic times. That depth of deposition was not the most important factor may be concluded from the fact that quite shallow-water deposits are met with at various horizons of the Raibl Beds of the Northern Calcareous Alps, but there is no trace of any German element in the faunas of these beds. Thus the comparison of the German Grenzdolomit sea with the present-day Baltic must be a long way from the truth. Even if we assume that differences in salinity were of more importance than depth, it is very difficult to understand why species with a world-wide distribution in Anisic times became subsequently restricted to the German area.

To turn now to the development in Palestine. This is

* Cf. Diener, "Die marinen Reiche der Triasperiode," Denkschr. Akad. Wiss. xcii. (1916).

remarkable as being the first instance in which marine Raibl species have been found associated with species typical of the German area. It is obvious from the condition of occurrence of the deposit that it is of an extremely shallow-water and probably littoral character. In fact, the collectors of the specimens state that the beds quickly wedge out both to the east and to the south, the evidence being that the actual Triassic shore-line was very close indeed to the collecting-localities. Some specimens of the yellow marl are a veritable "lumachelle" of shell-remains, one hand-specimen having yielded a number of specimens of *Ostrea montis caprilis*, *Pecten* aff. *discites*, and *Myophoria transversa*, together with single examples of *Myophoricardium lineatum*, *Myophoriopsis jordanensis*, *Daonella* sp., and *Mytilus* sp., with numerous imprints of *Plicatula fissistriata*.

It is therefore suggested that beds of a marine littoral facies alternate with beds of a brackish lagoon character in which the German Lettenkohle fauna is found. The abundance of *Cænothyris vulgaris* is rather remarkable at this horizon, as this species, although very common in the Upper Muschelkalk, is rare in the Lettenkohle and does not reappear in the Grenzdolomit. As, however, the local abundance of a species is determined rather by local conditions than by horizon, there is no reason why it should not occur in abundance above the Muschelkalk.

RELATION TO OTHER AREAS.

Hitherto no Triassic deposits have been definitely recorded from any district of Northern Africa east of Tunis, but much exploration-work remains to be done in this region. Many authors* have claimed a Triassic age for a portion of the "Nubian Sandstone," a sparsely fossiliferous formation of terrestrial origin which extends over large areas in Egypt, Sinai, and Arabia. The term "Nubian Sandstone" is best restricted to beds of Lower Cretaceous age, but, as unfossiliferous beds of the same lithological character occur in this region at all horizons from late Palæozoic to Cretaceous, this restriction is impossible, for practical reasons. In Blanckenhorn's† opinion, the beds in the Isthmus of Suez for which Douvillé suggests a Triassic age are probably Lower Jurassic.

It is thus of very great interest to find fossiliferous Triassic beds of a marine facies intercalated in the "Nubian

* Cf. Douvillé, "Les Terrains Secondaires dans le Massif de Moghara," Mem. Acad. Sc. Paris, liv. 1916, pp. 1-8.

† "Aegypten," Handb. Reg. Geol., Bd. vii. Abt. 9, 1921, pp. 43-44.

Sandstone" series, especially as this intercalation has the form of a wedge, rapidly thinning out to the east and to the south. In both these directions the "Nubian Sandstone" sequence is unbroken, so that here it almost certainly includes beds of Triassic age.

This discovery in Palestine also shows that the southern limit of the Triassic Tethys must be drawn considerably further to the south than has been done in most attempts to reconstruct the geographical conditions of this time.

It is, however, improbable that marine Triassic beds extend much further to the south in this district, as it has been seen that this deposit was probably formed very close to the old shore-line. Further north in Syria one may well anticipate the discovery of other Triassic exposures, and it will be of interest to study the changes in facies as we recede from the shore-line.

In conclusion, it will be seen that these beds and their fauna are of such great interest to students of the Triassic system that it is to be hoped that some future attempt will be made to collect from them. The cephalopod and reptilian fauna, in particular, will repay further study, while many more species of lamellibranchs must be represented than have been here described. The mode of preservation and softness of the matrix allow easy preparation of such details as hinge-structure, so that probably our knowledge of the affinities of many of the lamellibranch species will be increased by the study of specimens from this locality.

Moreover, the uniqueness of the association of species calls for detailed collecting bed by bed, in order that it may be definitely ascertained to what extent the two diverse faunas occur in association. There is no doubt that the conclusions reached as to the age of the fauna are open to some dispute, but these conclusions are based upon the identification of species which, although few in number, are so characteristic of the Upper Trias that their occurrence at a lower horizon would be extremely improbable.

EXPLANATION OF THE PLATES.

(The figures are of natural size, unless otherwise stated.)

PLATE I.

Figs. 1 a, b, c. Cœnothyris vulgaris (Schlotheim), B. 44770. P. 58.
Figs. 2 a, b, c. Cœnothyris vulgaris (Schlotheim), B. 44771. Circular, inflated variety. P. 58.

- Figs. 3 *a, b. Ctenothyrus vulgaris* (Schlotheim), B. 44772. Internal cast. *a*, ventral aspect; *b*, dorsal aspect. P. 58.
- Fig. 4. *Lingula* cf. *tenuissima zenkeri*, Alb., B. 44803. Slightly broken posteriorly. P. 59.
- Fig. 5. *Nucula* sp., L. 33300. P. 61.
- Figs. 6 *a, b, c. Reubenia hesbanensis*, sp. n., L. 33301. *a*, left valve; *b*, left valve, viewed from above hinge-margin, showing incurved umbo ($\times 1.7$); *c*, left valve, interior view, showing hinge-structure ($\times 1.7$). P. 63.
- Figs. 7 *a, b, c. Reubenia attenuata*, sp. n., L. 33301. *a*, view of left valve; *b*, view of right valve; *c*, view from above hinge-margin, showing the twist of the shell. P. 63.
- Fig. 8. *Reubenia* sp., L. 33305. View of left valve ($\times 1.7$). P. 64.
- Fig. 9. *Ostrea montis caprilis*, Klipstein, L. 33306. P. 65.
- Fig. 10. *Ostrea montis caprilis*, Klipstein, L. 33307. Interior view of a left (fixed) valve, showing posteriorly twisted apex ($\times 1.7$). P. 65.
- Figs. 11 *a, b. Ostrea montis caprilis*, Klipstein, L. 33308 ($\times 1.7$). *a*, right valve; *b*, left valve. P. 65.
- Fig. 12. *Plicatula moabensis*, sp. n., L. 33313. View of left (unfixed) valve. P. 66.
- Figs. 13 *a, b. Plicatula (Pseudoplicatunopsis) fissistriata* (Winkler), L. 33314. *a*, left valve; *b*, ornamentation of same, magnified ($\times 1.7$). P. 67.
- Fig. 14. *Plicatula (Pseudoplicatunopsis) fissistriata* (Winkler), L. 33315. Interior of right valve, showing plicatuloid dentition. P. 67.
- Fig. 15. *Daonella* sp., L. 33320. Right valve ($\times 1.7$). P. 64.
- Fig. 16. *Pecten [Pseudomonotis] inaequistriatus*, Munster, L. 33321. Left valve ($\times 1.7$). P. 68.
- Figs. 17 *a, b. Myalina tommasii obtusa*, Salomon, L. 33332. *a*, right valve, exterior; *b*, do., interior, showing striated ligamental area ($\times 1.7$). P. 73.
- Fig. 18. *Mytilus [Myalina]* sp., L. 33333 ($\times 1.7$). P. 75.

PLATE II.

- Fig. 1. *Lima lineata* (Schlotheim), L. 33330. Anterior aspect, showing elongated pseudo-lunule. P. 71.
- Figs. 2 *a, b. Mysidioptera cf. vis-costata* (Stoppani), L. 33331. *a*, left valve; *b*, anterior aspect of same. P. 72.
- Figs. 3 *a, b. Myophoriocardium lineatum*, Wöhrman (P), L. 33363 ($\times 1.7$). *a*, exterior of right valve; *b*, interior of right valve. P. 81.
- Figs. 4 *a, b, c. Myophoriopsis jordanensis*, sp. n., L. 33365 ($\times 1.7$). *a*, left valve, exterior; *b*, do., posterior aspect; *c*, do., interior. P. 82.
- Fig. 5. *Schafhuuthia subquadrata* (Parona), L. 33367. P. 83.
- Fig. 6. *Schafhuuthia subquadrata* (Parona), L. 33368. Internal cast. P. 83.
- Figs. 7 *a, b. Anodontophora münsteri* (Wissmann), L. 33335. *a*, view of left valve; *b*, view of hinge-margin, showing degree of inflation. P. 75.
- Fig. 8. *Anodontophora münsteri* (Wissmann), L. 33337. P. 75.
- Fig. 9. *Anodontophora münsteri* (Wissmann), var., L. 33339. P. 76.
- Fig. 10. *Myoconcha* aff. *goldfussi* (Dunker), Lick, L. 33341. P. 77.
- Fig. 11. *Myophoria transversa* (Bornemann), L. 33350 ($\times 1.7$). P. 79.
- Figs. 12 *a, b, c. Burmesia ? posteroradiata*, sp. n., L. 33375. *a*, exterior aspect, one left valve adheres to the surface of the other;

b, interior view, showing outline of valve; *c*, ornamentation of anterior portion of shell in the vicinity of the umbo. ($\times 2$) P. 85.

Fig. 13. *Trapezium* ? sp., L. 33343. P. 78.

Fig. 14. *Omphaloptycha* ? sp., G. 32502. P. 87.

Fig. 15. *Spirostylus* ? sp., G. 32503. P. 87.

Figs. 16 *a*, *b*. Ammonoid fragment, C. 25231. *a*, cross-section of last whorl, showing oxynote form; *b*, last whorl, as preserved, with some of sutures marked. P. 88.

III. — *A Revision of the Old World Cyrtacanthacrini (Orthoptera, Acrididæ)*.—V. *Genera Cyrtacanthacris to Loiteria* *. By B. P. UVAROV, F.E.S., Assistant Entomologist, Imperial Bureau of Entomology.

XXII. Genus CYRTACANTHACRIS, Walk.

The two species constituting this genus are such familiar insects that I think detailed description of the genus would be superfluous.

Key to the Species.

- 1 (2). Discoidal area of elytra coriaceous, with dense and thick reticulation. Pronotum with the metazona strongly widened; lateral lobes with large whitish spots. Spots and fasciæ on the elytra sharply defined. (Africa, Arabia, India, Ceylon.). 1. *tatarica* (L.).
- 2 (1). Discoidal area of elytra transparent, with remote and not thickened veinlets. Pronotum feebly widened in metazona; lateral lobes without whitish spots. Spots and fasciæ on the elytra indefinite, confluent, or lacking. (Africa.) 2. *æruginea* (Stoll).

1. *Cyrtacanthacris tatarica* (L.). (Figs. 11 A, 11 B, 11 C.)

1758. *Gryllus Locusta tataricus*, Linné, Syst. Nat. ed. x. i. p. 432. no. 46 (nec *Gryllus tataricus*, Cyrillo, Villers, Petagna. Fabricius, Charpentier; nec *Acridium tartaricum*, Olivier, Burmeister, Serville, Fischer, Fieber, Krauss; nec *Schistocera tatarica*, Kirby, Cat. iii. p. 459. no. 46).

1764. *Gryllus Locusta tataricus*, Linné, Mus. Lud. Ulr. p. 139. no. 30.

* Part I., Ann. & Mag. Nat. Hist. (9) xi. p. 130 (1923); Part II., *ibid.* p. 473; Part III., *ibid.* xii. p. 345; Part IV., *ibid.* xiii. p. 1 (1924).

1813. *Gryllus Locusta ranaceus*, Stoll, Represent. Spectr. Phasm. p. 80, pl. xiv b. fig. 53.
 1839. *A[cridium] ranaceum*, Burmeister, Handb. Entom. ii. p. 630. no. 7.
 1839. *A[cridium] æruginosum*, Burmeister, l. c. p. 630. no. 8 (nec Stoll).
 1839. *Acridium ruficorne*, Serville, Ins. Orth. p. 643. no. 2 (nec Fabr.).
 **1870. *Cyrtacanthacris concisa*, Walker, Cat. iii. p. 560.
 **1870. *Cyrtacanthacris subliturata*, Walker, l. c. p. 565.
 **1870. *Cyrtacanthacris interneza*, Walker, l. c. ix. p. 613 (partim).
 1870. *Cyrtacanthacris compta*, Walker, l. c. p. 613.
 *1878. *Acridium tataricum*, Stål, Rec. Orth. i. p. 61. no. 3.
 1889. *Acr[idium] tataricum*, I. Bolivar, Jorn. Acad. Sci. Lisboa, i. p. 160. no. 147.
 1906. *Acridium æruginosum*, Maxwell-Lefroy, Mem. Dep. Agric. India, i, no. 1. p. 53, pl. viii. fig. 3, pl. ix. fig. 3 †, pl. x. figs. 5 & 6 (nec Stoll).
 **1907. *Acridium æruginosum*, Finot, l. c. pp. 266, 342, 345 (nec Stoll).
 **1907. *Acridium ranaceum*, Finot, l. c. p. 342.
 1907. *Acridium tataricum*, Finot, l. c. pp. 313, 328, 345.
 1908. *Acridium tataricum*, I. Bolivar, Mem. Soc. Ent. Belg. xvi. p. 109. no. 107.
 1910. *Cyrtacanthacris compta*, Kirby, Cat. iii. p. 450. no. 31.
 1910. *Cyrtacanthacris ranacea*, Kirby, Cat. iii. p. 451. no. 35 (syn. excl.); p. 585. no. 35.
 1914. *Cyrtacanthacris ranacea*, Kirby, Fauna Brit. Ind., Acrid. p. 231. no. 279 (syn. excl.).

I have to give this somewhat long list of synonyms in full, as the synonymy of this species has always been in most extraordinary confusion, still more increased by Kirby's assumption that *tatarica*, L., is identical with *peregrina*, Ol. This statement is evidently founded on a study of the specimens in the collection of the Linnean Society of London, which are, however, not types of *tatarica*, L., since they are not labelled as such, and since Linné described the species from the Queen Ludovica Ulrica's collection (Syst. Nat. ed. x. i. p. 432). At the same time, Linné's original description, and still more the redescription given in Mus. Ludov. Ulr., leaves not the slightest doubt that he had before him not *peregrina*; the following points from the redescription are most decisive in this respect: "Thorax ferrugineus, lateribus albidis . . . Elytra testacea, maculis fuscis, costa sanguinolento-pallida, adspersa maculis fuscis . . . Femora postica . . . angulis fuscis." None of these characters, except the spotted elytra, can be applied to

† This figure bears the name *Acridium æruginosum*, Saussure (!), which never existed.

peregrina, Ol., while they agree perfectly well with *ranaceus*, Stoll. There is, moreover, no reason whatever to doubt Stål's detailed redescription of *tatarica*, L., based partly on the original type; I have also examined one of the specimens named by Stål (from Damaraland) which has been evidently compared by that author with the original type of Linné, and it has, of course, nothing to do with *peregrina*, Ol.

The reasons why I do not include *æruiginosus*, Stoll, in the synonymy of *tatarica* are given under that species (see below, p. 99), while *æruiginosum*, Burm., probably belongs here.

Three of Walker's species (*concosa*, *sublitturata*, and *internexa*) are treated as synonyms after a study of the types, and *compta*, of which no type exists, also undoubtedly belongs here according to the description; while *inficita*, Walker, which Kirby regarded as conspecific with *ranacea*, is in fact a synonym of *succincta*, L. (see above, Part III. p. 365). The characters given by Finot for separating *ranaceum* and *tataricum* are entirely worthless, and do not apply even to his specimens which are before me now.

It is quite extraordinary that this species, though much more widely distributed than any other of the genus, has produced no geographical subspecies and is extremely constant in all its characters, including the coloration and pattern; there is only a slight variability in the shape of the spots on the elytra, which tend sometimes to be confluent, and in this way some superficial resemblance to *C. ruficornis* may arise, the structural characters, however, being always amply sufficient to separate these two species.

Geographical distribution. I do not think it necessary to give here a complete list of localities whence I have seen specimens of this common and widely distributed species. Its area of distribution comprises the whole of South and Equatorial Africa, including Madagascar, and the Seychelles and Comoro Islands, up to Khartum and Massowah on the Red Sea (B.M.); it extends also through Sokotra (B.M.) and, probably, Southern Arabia to India, where it is widely distributed, reaching also Siam (B.M.) and Ceylon.

2. *Cyrtacanthacris æruiginosa* (Stoll).

1813. *Gryllus Locusta æruiginosus*, Stoll, Repres. Spectr. Phasm. p. 30, pl. 14 b. fig. 52 (nec Burm.).

1839. || *Acridium ruficorne*, Serville, Ins. Orth. p. 648. no. 2 (nec F.).

**1870. *Cyrtacanthacris variegata*, Walker, Cat. iii. p. 557. no. 18.

**1870. || *Cyrtacanthacris flavesceus*, Walker, l. c. p. 561. no. 24 (nec F.).

- +1870. *Cyrtacanthacris interneva*, Walker, l. c. iv. p. 613 (partim).
 *1873. *Acridium hottentotum*, Stål, Rec. Orth. i. p. 62. no. 4.
 1889. *Acridium lineatum*, I. Bolivar, Journ. Acad. Sci. Lisboa, i.
 p. 159. no. 142 (nec Stoll).
 1893. *Cyrtacanthacris lineatus*, Karsch, Berl. ent. Ztschr. xxxviii.
 p. 89. no. 46 (nec Stoll).
 1907. *Acridium hottentotum*, Finot, l. c. pp. 284, 345.
 1907. *Acridium walkeri*, Finot, l. c. p. 264 (nom. nov. for *flaves-*
 cens, Walk., nec F.).
 1908. *Acridium lineatum*, I. Bolivar, Mem. Soc. Entom. Belg. xvi.
 p. 108. no. 106 (nec Stoll).
 1910. *Cyrtacanthacris variegata*, Kirby, Cat. iii. p. 450. no. 33.
 1914. *Locusta hottentota*, Rehn, Wiss. Ergebn. Deutsch. Zentr.
 Afr. Exped. v. 1, p. 109.

In this species there is also confusion in the synonymy, and by most authors it has been called by Stål's name, *hottentotum*. There is no doubt, however, that Stoll's figure of *æruginosus* represents the same species, but the original specimen has been much discoloured. My reasons for this statement are as follows:—

(1) *G. æruginosus* cannot be conspecific with *ruficornis*, F., as the pronotum has a very low keel and a perfectly rounded fore margin; the pattern of the elytra also does not agree with that of *ruficornis*.

(2) Stoll says in the description that *æruginosus* is "verte à la tête," and *hottentotum*, Stål, is the only eligible species which has the head olive-green, while the pattern of the elytra agrees fairly well in the two species.

(3) The difference in the coloration of the hind tibiæ (pale in the figure of *æruginosus*, red in *hottentotum*) may depend on the bad preservation of Stoll's type.

(4) Stoll's *lineata* is conspecific, not with *hottentotum*, but with *ruficornis*, F. (see above, Part IV. p. 15).

When considering the synonymy of this species it must not be forgotten that it is subject to geographical variations, and at least three distinct subspecies may be separated, as the following key shows.

Key to Subspecies.

- | | |
|---|-----------------------------------|
| 1 (2). Hind tibiæ red. General coloration, especially the head, more or less olive-green. Elytra brown, with pale spots in the discoidal area. (S. Africa.) | 4 a. <i>æruginosus</i> [(Stoll).] |
| 2 (1). Hind tibiæ brownish grey. General coloration brown. Elytra without brown and pale pattern, unicolorous. | |
| 3 (4). Elytra with a sulphurous stripe in the scapular area. (E. Africa.) | 4 b. <i>flavescens</i> [(Walk.).] |
| 4 (3). Elytra without a sulphurous stripe in the scapular area. (W. Africa.) | 4 c. <i>unicolor</i> , subsp. n. |

1 a. *Cyrtacanthacris æruginosa æruginosa* (Stoll).
(Fig. 11 E.)

1813. *Gryllus Locusta æruginosus*, Stoll, l. c.
 **1870. *Cyrtacanthacris variegata*, Walker, l. c.
 **1870. *Cyrtacanthacris internexa*, Walker, l. c.
 *1873. *Acridium hottentotum*, Stål, l. c.

Geographical distribution. I have seen this subspecies from the following localities:—Cape (B.M.; G.M.; C.M.); Adelaide, S. Africa (B.M.); Port Elizabeth, Cape Prov. (C.M.); Bechuanaland (B.M.); Natal (B.M.); Smithfield, Orange Free State (O.M.); Vredefort Rd., O.F.S. (B.M.); Bloemfontein, O.F.S. (Pretoria Div. Ent.); Pretoria (Pretoria Div. Ent.); Rustenburg, Transvaal (Pretoria Div. Ent.); Damaraland (S.M.; Stål's specimens of *hottentotum*); Pietermaritzburg (B.M.); Potchefstroom, Transvaal (O.M.); Salisbury, Mashonaland (O.M.; B.M.); Sesheke, Rhodesia (B.M.); Feira, N. Rhodesia (B.M.); Nyanji to Feira, Portuguese E. Africa (O.M.); Congo (B.M.; types of *C. variegata*, Walk.); Libreville, Congo Belge (P.M.).

It is evident that its area of distribution comprises the whole of South Africa, and extends even, at least along the west coast, as far north as Libreville. One specimen in the Paris Museum from the island Fernando Po represents an intermediate form between this subspecies and *unicolor*, being unicolorous brownish on the elytra, but with the hind tibiae brownish red. Specimens from Rhodesia have often the pattern of the elytra indistinct, their general coloration distinctly greenish, and the hind tibiae red.

4 b. *Cyrtacanthacris æruginosa flavescens* (Walk.).
(Fig. 11 D.)

- **1870. *Cyrtacanthacris flavescens*, Walk. l. c.
 1907. [*Acridium*] *walkeri*, Finot, l. c.
 1921. [*Cyrtacanthacris variegata*, Chopard, Voyage G. Babault, Afr. Orient., Orth. p. 60, pl. i. fig. 9.

Well distinguished from the South African race by its general coloration and especially by the elytra being uniformly coloured, except for a bright sulphurous stripe in the scapular area and the anal area being of the same colour, as well as by the differently-coloured hind tibiae. There is, however, no structural difference between the two insects, and they are connected by some transitional forms (Rhodesian specimens of *æruginosa*, see above), so that there is no reason to separate them specifically.

Geographical distribution. Described originally from East

Africa, this subspecies occurs probably also on the inner grassy plateaux of the Congo, but in the forest-regions its place is taken by the next subspecies. I have studied a fairly long series of specimens from the following localities: Bukoba, Tanganyika Territory (B.M.); Uganda: Entebbe, Mawokota, Mabira Forest, Bureya (B.M.; a long series of specimens); Nyarugenje, Central Ruanda (G.M.); Congo (B.M.); E. Africa (B.M.; type of *flavescens*, Walk.).

4 c. *Cyrtacanthacris æruginosa unicolor*, subsp. n.

As indicated in the key, this new subspecies is characterized by the uniformly dull brown general coloration, the absence of the sulphurous stripe in the scapular area being an especially useful character for separating *unicolor* from *flavescens*. The median stripe on the pronotum is also not as pale in *unicolor* as it is in the two other subspecies, and the lower margin of the pronotal lobes is without a narrow sulphurous stripe, which is so distinct in *flavescens*. There is no brown submarginal fascia on the lobes in the holotype, the lobes being thus unicolorous throughout, but this fascia appears in some of the paratypes, though it is always broader and less definite than in *flavescens*.

Described from a female holotype in the British Museum, from Aburi, Gold Coast (*W. H. Patterson*). The paratypes are as follows: Camerun, 2 ♂♂, 1 ♀ (G.M.); Abetifi, Gold Coast, 1 ♀ (G.M.); Camerun, 2 ♀♀; Ogove, 1 ♀; Aburi, Gold Coast, 2 ♀♀; Lagos, 1 ♀; Sierra Leone, 1 ♀; Oban distr., S. Nigeria, 1 ♂, 1 ♀; Bibianaha, Gold Coast, 2 ♀♀; Shengay, N. Sherbro distr., Sierra Leone, 1 ♂; Degema, S. Nigeria, 1 ♀ (all in B.M.).

Geographical distribution. As is obvious from the above list of localities, *unicolor* is a western race, evidently connected with forests. Its eastern limits are yet unknown, but it spreads probably as far east as the forests go. Some specimens of *flavescens* from Uganda, in fact, must be regarded as transitory to *unicolor*.

XXIII. Genus *KRAUSSARIA*, nov.

Frontal ridge in profile almost straight, somewhat reclinate. Face more or less punctured. Distance between the eyes less than the length of an eye and broader than the frontal ridge. Pronotum distinctly compressed laterally, slightly narrowed, but not constricted in the prozona; median keel low, in profile straight, tectiform; hind angle a

little more than 90°, not rounded. Elytra broad and short, remotely reticulated. Hind femora short and thick, hardly attenuate in the apical part. Hind tibiae with 7 outer and 9 inner spines. Male cerci triangular, somewhat longer than the anal plate, with the apex more or less incurved. Male subgenital plate pyriform, with short acute apex.

One of the three species referred to this genus, well differentiated by a number of characters, but especially by the shape of the male subgenital plate, viz., *K. angulifera*, differs considerably from the two others in the shape of the pronotum and in the type of coloration, but these characters are hardly sufficient for its generic separation.

Cyrtacanthacris corallinipes, Karsch, probably also belongs here, but I have not seen this species.

Key to the Species.

- | | |
|---|----------------------------------|
| 1 (2). Median keel of pronotum distinctly raised and tectiform; surface of the pronotum somewhat velvety, scarcely punctured. General coloration brownish, with chocolate-brown or blackish pattern; elytra with subobsolete large brown spots. (Senegal, Sudan, Arabia.) | 1. <i>angulifera</i> [(Krauss).] |
| 2 (1). Pronotum with the median keel low and scarcely tectiform; its surface densely punctured. General coloration green; elytra not spotted. | |
| 3 (4). Pronotum with irregular blackish or reddish-brown fasciae on the sides of the disc and on margins of lateral lobes. Hind femora with the base of the knee-lobes and lateral semilunar spots on the latter black. Hind tibiae with the extreme base black. (S.E. Africa.) | 2. <i>prasina</i> (Walk.). |
| 4 (3). Pronotum uniformly green. Semilunar spots on the hind knees and the base of the hind tibiae red. (E. Africa.) | 3. <i>dius</i> (Karsch). |

1. *Kraussaria angulifera* (Krauss).

**1877. *A[cridium] anguliferum*, Krauss, Sitz. Akad. Wiss. Wien, lxxvi. 1 Abt. p. 31. no. 1, pl. i. figs. 1, 1 A.

**1907. *Acridium anguliferum*, Finot, l. c. 271.

This is a very distinct species, showing a relationship to the genera *Acanthacris* and *Cyrtacanthacris*.

I have studied only a few specimens, and therefore can say nothing about its geographical or individual variability. A single specimen in the British Museum from Arabia differs from the African specimens in its somewhat smaller size, the disc of the pronotum having no distinct transverse

fascia, and in the more distinctly maculate elytra, with pale sulphurous stripes in the mediastinal and anal areas ; if these characters prove to be constant in all Arabian representatives of the species, they must be regarded as forming a distinct subspecies.

Geographical distribution. Originally described from Senegal, this species ranges from Gambia to Southern Arabia, as is evident from the following localities whence I have seen specimens :—

Gambia (B.M.) ; Haut Dahomey (P.M.) ; Dar-Banda méridional, Krebedjé (Fort Sibut) (P.M.) ; Dagana, Senegal (W.M. ; Krauss' type) ; Fort Lamy, Bas Chari (P.M.) ; Dakar, Senegal (P.M.) ; Sudan (W.M.) ; Upper Nile (B.M.) ; Senaar, Blue Nile (B.M.) ; Cheren, Erithræa (M.M.) ; Ktubu, Arabia (B.M.).

2. *Kraussaria prasina* (Walk.). (Fig. 12 A.)

**1870. *Cyrtacanthacris prasina*, Walker, Cat. iii. p. 562. no. 27.

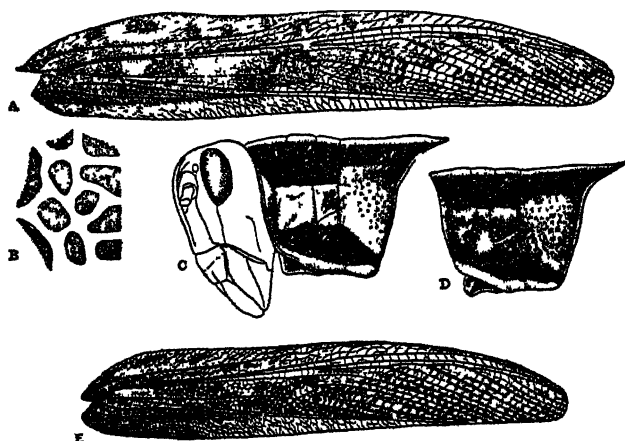
**1870. *Cyrtacanthacris auricornis*, Walker, l. c. p. 563 no. 28.

**1889. *Acr[idium] prasinum*, I. Bolivar, Jorn. Acad. Sci. Lisboa, i. p. 160. no. 146.

**1902. *Cyrtacanthacris distanti*, Kirby, Trans. Ent. Soc. Lond. p. 103. no. 107.

1903. [*Acridium*] *finoti*, I. Bolivar (nom. nov. for *prasinum*, Bol., nec Walk.).

Fig. 11.



A, B, C. *Cyrtacanthacris tatarica* (L.) (Figure B represents a strongly enlarged portion of the discoidal field of elytra) ; D. *C. æruginosa flavescens* (Walk.) ; E. *C. æruginosa æruginosa* (Stoll).

As the types of all four species mentioned in the synonymy are before me, their identity is beyond any doubt.

As Kirby himself said (*loc. cit.* p. 104), his *C. distanti* is but a pale form of *C. prasina*, Walk.

The coloration of the hind tibiae is either red or green, but these seem to be purely individual variations. The radial veins of the elytra are often red.

Geographical distribution. Natal (B.M.; types of *prasina*, Walk., and *auricornis*, Walk.); Pretoria (B.M.; type of *distanti*, Kirby); Salisbury, Mashonaland (B.M.); Lorenzo-Marquez (M.M.; types of *prasina*, Bol.).

It seems from these scanty data that the species is confined to S.E. Africa.

3. *Kraussaria dius* (Karsch).

1896. *Cyrtacanthacris dius*, Karsch, Stett. ent. Ztg. lvii. p. 294. no. 57.

This species is quite distinct from *K. prasina*, not only in colour-characters, but also in the shape of the pronotum, which has a more flattened disc, forming distinct rounded angles with the lateral lobes, while in *Ch. prasina* it is distinctly rounded. Further, the elytra of *dius* are broader and with a more regular reticulation.

Geographical distribution. Originally described from Usambara, E. Africa, and known to me by two specimens from the River Voi, Brit. E. Africa (M.M.), named by I. Bolivar.

XXIV. Genus *FINOTINA*, nov.

Closely related to *Kraussaria*, but differing from it in the male genitalia, the male cerci being not incurved apically, and the subgenital plate simply conical.

Key to the Species.

- | | |
|--|-----------------------------|
| 1 (2). Pronotum coarsely rugulose. Face strongly punctured. Elytra unicolorous. Hind knees with reddish semilunar spots. (Madagascar) | 1. <i>radama</i> (Brancs.). |
| 2 (1). Pronotum almost smooth, shining. Face scarcely punctured. Elytra with more or less distinct transverse brown fasciae or spots in the apical half. Hind knees with black semilunar spots. (Madagascar) | 2. <i>ranavaloe</i> (Fin.). |

1. *Finotina radama* (Brancs.). (Fig. 12 B.)

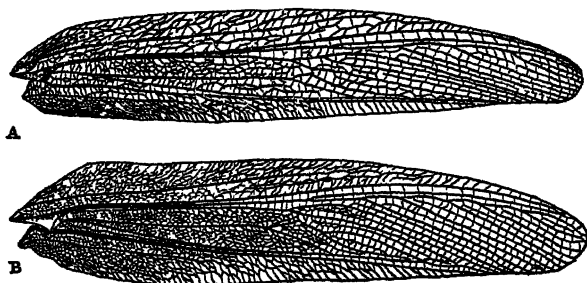
1892. *Acridium radama*, Brancsik, Jahresh. Ver. Trencs. Com. xv.-xvi. p. 191.

*1907. *Acridium radama*, Finot, l. c. p. 296.

Strongly resembling the preceding species in the shape and sculpture of the pronotum, but easily separated by the coloration of the elytra, and differing markedly in the male genitalia.

Geographical distribution. Probably confined to Madagascar, whence I have seen five specimens (P.M.—Finot's specimens; G.M.; M.M.).

Fig. 12.



A. *Kraussaria prasina* (Walk.); B. *Finotina radama* (Brancs.).

2. *Finotina ranavaloe* (Finot).

**1907. *Acridium ranavaloe*, Finot, l. c. p. 297.

Easily recognised by the almost smooth pronotum and spotted elytra, though this latter character is probably not quite constant.

Geographical distribution. Also a Madagascan species, known to me only by the two types of Finot from Tamatave (P.M.).

XXV. Genus *CHONDRACRIS*, nov.

Frontal ridge in profile distinctly convex, reclinate, forming a widely rounded angle, or even a bow, with the fastigium. Face smooth or somewhat rugulose. Fastigium of the vertex strongly sloping, not impressed. Distance between the eyes distinctly exceeding the horizontal diameter of an eye; the height of an eye is less than the height of the subocular sulcus. Pronotum distinctly compressed laterally, but not constricted in the prozona, with the fore margin distinctly angulate and with the hind angle acute or straight, seldom (in *Ch. baumanni*) rounded; the upper surface coarsely granulated throughout, including the median keel; lateral lobes granulated except in the middle;

the median keel distinctly or strongly raised, tectiform. Elytra transparent throughout, or subcoriaceous at the base. Wings with the base rose (in *Ch. sanguinea* unknown, but probably the same). Hind femora narrow, with the upper outer keel straight; all keels serrate and granulate. Hind tibiae with 8–9 outer and 10–11 inner spines.

Genotype: *Acrydium roseum*, De Geer.

This genus is not very homogeneous, and possibly might better be split up into three different genera: one comprising *asperata*, *uvarovi*, and *baumanni*, and two for *rosea* and *sanguinea*, respectively; I abstain, however, from doing this, since none of the species, except *rosea*, is sufficiently well known, and they are, at any rate, fairly closely related to each other, the peculiar shape and sculpture of the pronotum and the shape of the head being very characteristic for all five species.

Key to the Species.

- 1 (8). General coloration uniformly green or brown, sometimes variegated with red.
- 2 (3). Pronotum not strongly compressed laterally, with the median keel obtuse and low, and the hind angle rounded. Hind tibiae blackish from above, olivaceous from below. (W. Africa.) 1. *baumanni* [(Karsch).]
- 3 (2). Pronotum strongly compressed laterally, with the median keel sharp and arched; the hind angle straight, or even acute.
- 4 (5). Fastigium of the vertex more or less distinctly margined, moderately sloping, forming a widely rounded angle with the frontal ridge, which is practically straight in profile. Lateral facial keels, when seen in profile, obtusangulately broken just below the antennae, straight elsewhere. Distance between the eyes, even in the female, not exceeding the height of an eye. Wings with the base rose and the rest greenish, hyaline. (China, India, Formosa, Java, Sumatra.) 2. *rosea* (De Geer).
- 5 (4). Fastigium of the vertex scarcely, or not at all, margined, strongly sloping, in profile forming a broad bow with the frontal ridge, which is distinctly convex in profile. Lateral facial keels seen in profile arched throughout. Distance between the eyes, even in the male, subequal to the height of an eye.
- 6 (7). Elytra in both sexes extending well beyond the hind knees. Wings with more than

- the basal half brick-red, elsewhere yellowish infumate, with the veins scarcely darker than the membrane. Hind tibiae olivaceous, with the spines yellow. (W. Africa, Angola.) 3. *asperata* (Bol.).
- 7 (6). "Elytra, even in the male, scarcely extending beyond the hind knees, in the female scarcely reaching them. Wings with the extreme base rose, and the rest brownish infumate, with the veins and veinlets dark brown. Hind tibiae dark reddish brown, with the spines more or less reddish." (Tanganyika Territory.) [sp. n.*].
- 8 (1). General coloration reddish brown, but not uniform, the elytra being obliquely fasciated with white. Pronotum short; its median keel strongly raised, sharp; the metazona sideways from the keel depressed, its surface forming distinct, though rounded, angles with the lateral lobes. (The coloration of wings and of hind tibiae uncertain, all known specimens being from alcohol.) (E. Africa.) 4. *uravovi*, Sjöstedt,
5. *sanguinea* (Sjöst.).

1. *Chondracris baumanni* (Karsch).

1893. || *Cyrtacanthacris roseus*, Karsch, Berl. ent. Ztschr. xxxviii. p. 88. no. 44 (nec De Geer!).

1896. *Cyrtacanthacris baumanni*, Karsch, Stett. ent. Ztg. lvii. p. 293. no. 56, fig. 22.

I have before me only two female specimens, which both agree perfectly well with the original description and figure.

Geographical distribution. Described from Bismarckburg and Misahöhe in Togo; specimens before me are: Togo (M.M.); Kamerun (S.M.).

2. *Chondracris rosea* (De Geer).

I do not quote the synonyms of this species as they are all correctly recorded by Kirby (Cat. iii. p. 447. no. 11), except that *Cyrt. fortis*, Walker, belongs here only in part (see Part II. p. 352, Part III. p. 362).

It has been noticed already by Brunner von Wattenwyl (Ann. Mus. Genova, xxxiii. p. 159. no. 1) that two forms of this species may be distinguished, differing in the shape of the pronotum, and this I am able to corroborate, these two forms being good geographical races, which can be separated by the following key.

* Communicated to me with the above diagnosis by Prof. Y. Sjöstedt,

Key to Subspecies.

- 1 (2). Median keel of the pronotum moderately raised in prozona, and low, straight in profile, in metazona; the latter only feebly tectiform, its disc forming distinct angles with the lateral lobes. Elytra exceeding the hind knees by one-fourth of their total length. (China).. 2 *a. rosea* (De Geer).
- 2 (1). Median keel of the pronotum strongly raised and arched throughout; metazona tectiform, its disc sloping into the lateral lobes. Elytra longer, exceeding the hind knees by about one-third of their total length. (India; Indo-China; Malaya.) 2 *b. brunneri*, [subsp. n.]

2 *a. Chondracris rosea rosea* (De Geer).

As the original description by De Geer, as well as the descriptions of *Gryllus flavicornis*, F., and *Cyrtacanthacris lutescens*, Walk., which two names are recognised synonyms of *rosea*, are based on the types from China, the subspecific name *rosea* should be applied to the Chinese race. Its differences from the southern subspecies are, of course, of relative character only, and the height of the pronotal crest and the length of the elytra tend to increase from North to South, the North Chinese specimens being strikingly distinct from Javanese ones, while specimens from Burma and India hold an intermediate position, though they may be better referred to the southern race.

Geographical distribution. N. China; Chung-King, Sze-Chuan Prov., W. China; Hainan Island; Chusan Island (all B.M.).

Shiraki's record of this species being common in Formosa (Acrid. Japans, p. 64. no. 1, pl. ii. fig. 11) refers also to this subspecies, according to his figures. On the other hand, Brunner's indication that the low-crested Chinese race occurs in Cochin China seems to me to be doubtful, and applies probably to an intermediate form, such as occurs in India.

2 *b. Chondracris rosea brunneri*, subsp. n.

Besides the characters given in the key (see above) this subspecies differs from the northern one by its somewhat larger size. The dimensions of the holotype (a female from Java) are as follows: b. 83; p. 22; h.f. 43; el. 74. One of the male paratypes (from Java) has the following dimensions: b. 60; p. 15; h.f. 29; el. 52.

Described from seven specimens in the British Museum : Java, 1 ♀ (holotype); Java, 1 ♂, 1 ♀; Bangkok, 1 ♀; Assam, 1 ♀; Silhet, 1 ♂, 1 ♀; two more paratypes are in the Vienna Museum: Amboina, 1 ♀; Calcutta, 1 ♀. Three more specimens have been sent to me by Dr. W. Roepke from Samarang and Buitenzorg, Java, after the description was completed.

3. *Chondracris asperata* (Bol.).

**1881. *Acridium asperatum*, I. Bolivar, Jorn. Acad. Sci. Lisboa, viii. p. 112. no. 25.

This African species is extremely like the Oriental *rosea*, but undoubtedly differs from it specifically by the characters given in the key.

Geographical distribution. Ambriz and Duque de Braganza, Angola (M.M.), are the only known localities for this species.

4. *Chondracris uvarovi*, Sjöstedt.

A detailed description of this species will be given by its author elsewhere; its dimensions (as communicated to me by Prof. Sjöstedt) are as follows: ♂, body 38; pron. 9.5; elytr. 20; h. fem. 22; ♀, body 53; pron. 14; elytr. 40; h. fem. 36 mm.

Geographical distribution. Manow, Tanganyika Territory (S.M.).

5. *Chondracris sanguinea* (Sjöst.).

**1912. *Acridium sanguineum*, Sjöstedt, Ark. Zool. vii. 38, p. 28, pl. iii. figs. 3, 3 a.

1914. *Locusta rugegeana*, Rehn, Wiss. Ergebn. Deutsch. Zent.-Afr. Exped. v. 1, p. 109.

Rehn's detailed description agrees perfectly well with the type of *sanguinea*.

Geographical distribution. Brit. E. Africa (S.M.; type of *sanguineum*); Brit. E. Africa, 4000 to 4500 ft. (B.M., 1 ♀). Rehn's record is from Rugege forest, S.W. Ruanda.

XXVI. Genus *LOITERIA*, Sjöst.

1921. *Loiteria*, Sjöstedt, K. Sv. Vet.-Akad. Handl. lxii. no. 3, pp. 91, 271.

The whole habitus of this insect, as well as some of its most important characters (the structure of the pronotum with its four sulci, semicircular wings, etc.), renders its true systematic position very uncertain, and I doubt whether it

should be included in *Cyrtacanthacrini* at all, in spite of the shape of the mesosternal lobes, which is, according to the original description, typical for the group; for practical considerations, however, it is not desirable to leave the genus out of the revision.

Only the genotype is known.

1. *Loiteria rubripes*, Sjöst.

1921. *Loiteria rubripes*, Sjöstedt, *l. c.* p. 271, pl. xvi. figs. 14, 14 a.

Described from a single female from Rockhampton, Queensland (type in the Hamburg Museum).

SPECIES NOT IDENTIFIED GENERICALLY.

**1870. *Acridium consobrinum*, Walker, Cat. iv. p. 636.

Kirby included this species in the genus *Cyrtacanthacris* (Cat. iii. p. 448) and recorded it from Aru and Timor Laut, but the type is a female from an unknown locality and most likely a member of the New World genus *Schistocerca*.

1871. *Acridium cribrifrons*, Walker, Cat. v., Suppl. p. 60.

The type of this species is lost, but it has been described from the same Mr. Rendall's collection from Gambia as *Phyzacra strenua*, Walk. (see above, Part II. p. 474), and represents probably the other sex of that species.

1891. *Acridoderes prasinus*, Karsch, Berlin. ent. Ztschr. xxxvi. p. 182.

Has certainly nothing to do with the genus *Acridoderes* as understood by me, and belongs probably to an undescribed genus related to *Rhytidacris* (see above, Part II. p. 482), but differing from it in the feebly carinated pronotum and subconical prosternal tubercle.

1895. *Acridium manilense*, Stål, in Elera, Cat. Sist. Fauna Filipinas, ii. p. 204.

A *nomen nudum*, as Stål never described such a species.

1896. *Cyrtacanthacris corallinipes*, Karsch, Stett. ent. Ztg. lvii. p. 295.

The description of this species from Uganda is too unsatisfactory to permit generic identification; perhaps belongs to *Kraussaria*.

1896. *Cyrtacanthacris decipiens*, Karsch, l. c. p. 298, fig. 23.

Belongs to an evidently undescribed genus related to *Chondracris*, but with the prosternal spine straight.

1897. *Acridium zehntneri*, Krauss, in Zehntner, Med. van het Proefstat. Oost-Java, n.s. no. 37, p. 43.

Probably one of the subspecies of *Valanga nigricornis*, and most likely identical with subsp. *melanocornis* (see above, Part III. pp. 348, 354).

1916. *Cyrtacanthacris feejeeana*, L. Brunner, Proc. Haw. Ent. Soc. iii. p. 158.

Only measurements of the species are given, but no description; probably a member of the genus *Austracris*.

A Correction.—The genotype of *Gowdeya* is indicated in my key to genera as *G. ugandana*, sp. n. (Part I. p. 143), but this is a *nomen nudum*, and the species has been described under the name *G. picta*, sp. n. (Part III. p. 360).

ALPHABETICAL INDEX.

[New genera, species, and subspecies are marked with an asterisk; synonyms are printed in italics. Roman figures indicate the part, Arabic the page.]

- **Acanthacris*, I., 144; IV., 14.
- Acridium*, I., 130.
- Acridoderes*, I., 133, 139; II., 475.
- Acrydium*, I., 130.
- ægyptium*, II., 487.
- æruginea*, V., 98.
- æthiopicum*, II., 488.
- albidiferum*, II., 487.
- **allorencia*, III., 352.
- amethystina*, II., 480.
- amanula*, IV., 17.
- **Anacridium*, I., 141; II., 486.
- **Anacridoderes*, I., 139; II., 476.
- angulifera*, V., 102.
- asperata*, V., 109.
- assectator*, III., 365.
- auricornis*, V., 103.
- **Austracris*, I., 143; IV., 1.
- basalis*, IV., 6.
- baumanni*, V., 107.
- bimaculata*, II., 490.
- **brunneri*, V., 108.
- **Bryophyma*, I., 141; II., 480.
- carenicolle*, III., 355.
- cavroisi*, IV., 13.
- celebensis*, III., 353.
- **Chondracris*, I., 141; V., 105.
- citrina*, IV., 16, 18.
- coangustatum*, IV., 7, 10.
- cœrulans*, II., 474.
- caruleus*, II., 474.
- cognatum*, III., 362.
- compta*, V., 97.
- conclisa*, IV., 16; V., 97.
- Congoa*, I., 134, 139; II., 477.
- consanguineum*, III., 354.
- consobrinum*, V., 110.
- **conspersa*, III., 354.
- corallinipes*, V., 110.
- crassus*, II., 476.
- cribrifrons*, V., 110.
- cuspidatum*, IV., 4.
- cyanea*, IV., 9, 10.

Cyrtacanthacris, I., 133, 144;
V., 96.

debilis, II., 481.
decipiens, V., 111.
*decisa, IV., 17.
deckeni, IV., 19.
disparilis, III., 355.
distanti, V., 103.
dius, V., 104.

*elegans, III., 359.
elongatum, III., 365.
exacta, IV., 4.
excavata, III., 356.
eximia, II., 488.

fascifera, IV., 7.
feejeeana, V., 111.
finoti, V., 103.

*Finotina, I., 144; V., 104.
flavescens, II., 488; V., 100.
flavicornis, V., 108.
flaviventris, II., 484.
fortis, II., 352; III., 362.
fulva, IV., 16.
fumosa, III., 354.
fusilinea, III., 365.

geniculata, III., 356.

*Glaphyra, I., 144; IV., 9.
gohieri, III., 355.

*Gowdya, I., 143; III., 359.

*gracilis, IV., 4.
graminea, III., 353, 362.
gregaria, II., 481.
guttulosa, IV., 2, 4.
gyldenstolpei, IV., 17.

hottentotum, V., 99.
humilicrus, II., 489.

illepida, IV., 3, 4.
illustrissima, II., 489.
imitatrix, IV., 5.
inchyta, IV., 13.
indecisum, II., 487.
inficita, III., 365.
internexa, IV., 12; V., 97, 99.
irregularis, III., 358.

japonica, III., 364.

katanga, II., 477.
*Kraussaria, I., 144; V., 101.

laetum, III., 352.
laevigatus, II., 477.
*lineata, IV., 15.
Locusta, I., 133.
Loiteria, I., 133, 144; V., 109.
*lombokensis, III., 353.
luteicornis, III., 364.
lutescens, V., 108.

maculicollis, III., 358.
magnifica, IV., 11, 12.
manilense, V., 110.
melanocorne, III., 352, 353.
melanocornis, III., 354.
melanorhodon, II., 488.
meleager, III., 351.

*Melicodes, I., 143; III., 360.
modesta, III., 351, 357.
moestum, II., 488.

*nana, IV., 4.
neocaledonicum, IV., 3.
nigricornis, III., 351, 352.
nigrispinis, II., 476.
nigrispinum, IV., 18.
nigrovaria, III., 355.

*Nomadacris, I., 143; IV., 7.

orientalis, IV., 11.
Ornithacris, IV., 9.
Orthacanthacris, I., 133, 142;
II., 489.

*Pachyacris, I., 140; II., 477.
*Pachynotacris, I., 140; II., 479.
pallidicornis, IV., 15.
papuasica, III., 356.
paranensis, II., 484.
pardalinum, II., 488.
parvula, IV., 3.
*Patanga, I., 143; III., 362.
peregrina, II., 484.
Phyzacra, I., 134, 138; II., 473.
*picta, II., 481; III., 360.
pictula, IV., 12.
plagiata, IV., 5, 6.
prasina, V., 103.
prasinus, II., 475; V., 110.
proxima, IV., 5.
pulchripes, III., 357.
punctata, II., 483.
purpurifera, IV., 7.

radama, V., 104.
runaceus, V., 97.

- ranavalosæ*, V., 105.
renkensis, II., 474.
**Rhadinacris*, I., 141; II., 485.
**Rhytidacris*, I., 141; II., 482.
rosea, V., 107.
**rouxi*, III., 357.
rubellum, IV., 7, 12.
rubescens, III., 365.
rubripes, V., 110.
ruficornis, IV., 14, 17; V.,
rugeyeana, V., 109.

sanctæ-mariæ, IV., 7.
sanguinea, V., 109.
**saravakensis*, III., 353.
Schistocerca, I., 133, 141; II.,
 483.
schistocercoides, II., 485.
scrobiculatus, II., 474.
sellatum (*subsellatum* in the text
 is a misprint), II., 484.
septemfasciata, IV., 7, 10.
sigillata, II., 482.
signata, III., 359.
**sjostedti*, III., 357.
sphulera, II., 488.
stercoraria, III., 359.
sternocardias, III., 365.
strenua, II., 474.
subimmaculata, IV., 18.
sublaturata, V., 97.

subsellata, II., 484; IV., 7.
succincta, III., 365; IV., 15.
**sumatrensis*, III., 354.

tatarica, II., 484; V., 96.
tectifera, II., 483.
tenebrosa, III., 362.
tereticolle, IV., 13.
transiens, III., 356.
turbida, IV., 13.

**ugandana*, I., 143.
**unicolor*, V., 101.
**uvarovi*, V., 109.

**Valanga*, I., 143; III., 345.
validiceps, II., 476.
variegata, V., 98, 99.
variolosa, II., 474.
vinosa, II., 478.
violascens, II., 478.
vittata, III., 358.
vittaticollis, III., 362.

walkeri, V., 100.
wernerella, II., 488.
**Willemsea*, I., 142; II., 489.
wingatei, II., 478.

zehntneri, V., 111.

IV.—*New Species of Cucumaria from Monterey Bay, California* *. By HARRINGTON WELLS.

[Plate III.]

DURING the summer of 1923, the author was engaged in making a survey of the Holothurioides occurring between the tides and in the shallow water of Monterey Bay. A limited amount of bottled material, previously collected, was available at the Hopkins Marine Station. These specimens served as a working nucleus. Material and literature in the department of Zoology at Stanford University were also drawn upon as needed. The thesis

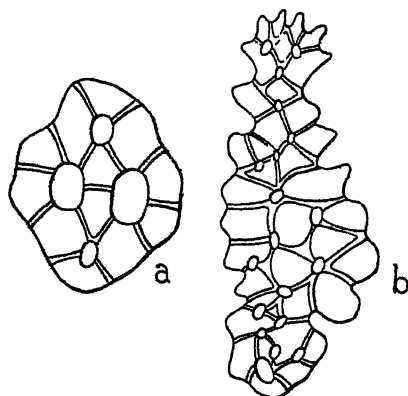
* From the Hopkins Marine Station of Stanford University. Communicated by W. K. Fisher.

which embodied the results of this investigation was presented to the University in partial fulfilment of the requirements for the degree of Master of Arts. Of the twelve species recorded, three are believed to be new and another is placed as a distinct variety. A discussion of these Holothurians, all of which are members of the genus *Cucumaria*, is the purpose of this paper.

Cucumaria fisheri, sp. n.

Description.—Tentacles 10, dendroid, all equal in size. Length of largest adult in life 60 mm.; width 10 mm.; length of same specimen in alcohol 47 mm. Colour in life

Fig. 1.



Cucumaria fisheri. a, small 4-holed button; b, medium-sized spiny button.

yellow, with prominent brown spots scattered over the surface of the body; colour in alcohol white, with blackish-brown spots. The pedicels are in a double row along each ambulacrum. There are no pedicels on the interambulacra. Five small anal papillæ are present. The retractor muscles are given off from the longitudinal muscles at a point about two-thirds the length of the animal, measuring from the anterior end. Respiratory trees 2. Polian vesicle 1, about 12 mm. in length, situated just to the left of the median dorsal ambulacrum. Stone-canal single; the madreporic plate being imbedded in the dorsal mesentery to the right of the median dorsal ambulacrum. Calcareous

deposits: numerous thick knobbed buttons with from two to forty perforations. Most of these buttons have one end drawn out as a spiny projection.

Type.—The type will be deposited in the U.S. National Museum; paratypes in the British Museum (Natural History), Museum of Comparative Zoology, and in the Zoological Collections of Stanford University.

Specimens examined.—Twenty-two, from off Monterey, shale, 12 fathoms; and from *Macrocystis* "hold-fasts," 1 fathom.

Discussion.—Clark* mentioned this *Cucumaria*, believing it to be *C. albida*, Brandt. He examined but one specimen (sent from Pacific Grove, Calif.), and described it as follows:—"One specimen is apparently an individual of the species which Selenka described as '*Cucumaria albida*, Brandt.' It is 75 mm. long and is perfectly white, though in life it is said to have been 'yellowish with brown spots.' The calcareous deposits are not abundant, and agree exactly with Selenka's figure. The specimen, moreover, agrees with his descriptions, except that there is only one Polian vesicle and one stone-canal."

Selenka† also described but a single specimen, preserved in alcohol. My translation of his description runs as follows:—"Brandt describes the species thus: 'The anus is armed with five teeth. The tube-feet are in five broad longitudinal rows; in each row 2-4 feet are close together. The calcareous deposits of the skin are oblong in shape, .06 mm. long, and take the form of scattered plates. The sucking-disks on the feet are very small. The animal is uncoloured; the tentacles brownish. Only one specimen, 50 mm. long and 10 mm. thick, lies before me. The tentacles are like those of *Cucumaria frondosa*, Gunn. Five large retractor muscles arise in the middle of the body, and are inserted in the calcareous ring, which is shaped like that of *Psolus phantapus*. Around the circular canal hang many (about 60) little button-shaped stone-canals; and on the ventral side are three Polian vesicles. Habitat: Sitka.' Brandt's all-too-short description will pass very well for the specimen before me. His account fits my specimen so closely that it is not improbable that it belongs to *C. albida*, hence I do not hesitate in classifying it under that head."

* "The Holothurians of the Pacific Coast of North America," Zool. Anz. vol. xxiv. p. 185 (1901).

† Zeitschr. für Wiss., Zoologie, vol. xvii. (1867).

Accompanying Selenka's description is one figure of a button, more or less oblong in shape, perforated by five holes. An occasional spicule may have a shape resembling this figure, but the great majority agree far better with the spicules pictured by Semper (1868) as *C. leonina*. It was this latter resemblance that caused Clark to believe that a few small white *Cucumarias* which he had in his collection were specimens of *Cucumaria miniata*, Brandt. These specimens, however, were in reality members of the species *C. fisheri*, but they differ so markedly in several respects that I have placed them as a distinct variety, and will describe them in detail under a separate head.

Ludwig* states that in his opinion Brandt's *Cladodactyla miniata* is identical with *Cucumaria frondosa*, Gunn. In the same group he places *Cucumaria californica*, Semper, *Cucumaria japonica*, Semper, *Cucumaria fallax*, Ludwig, and *Cucumaria albida*, Selenka. Of this last, which concerns us at present, he says, in German: "We must, however, put *Cucumaria albida*, Selenka, which, as we have seen, cannot be, as Selenka believed, identical with Brandt's *Cladodactyla albida*, in the same group as *Cucumaria frondosa*; for I am positive that Selenka's *Cucumaria albida* is but a young specimen of *Cladodactyla miniata*, Brandt. All in all, I believe both *Cucumaria albida*, Selenka, and *Cucumaria fallax* (my own species) to be identical with *Cladodactyla miniata*, Brandt."

To sum up, then: In my opinion Selenka's specimen was in reality a young *Cucumaria miniata*. A careful comparison of the two descriptions, as well as a painstaking perusal of the available literature bearing on the subject in point, leaves no doubt of this. Clark (*loc. cit.*) undoubtedly had before him a single specimen of *Cucumaria fisheri*. He remarks that the collector said the animal was yellow with brown spots when alive. He states that there is only one Polian vesicle and one stone-canal in his specimen, while both Selenka and Ludwig insist that *Cucumaria albida*, Selenka, has three Polian vesicles and many (about 60) stone-canals! Clark states that in his specimen "the calcareous deposits are not abundant, and agree exactly with Selenka's figure." The only conceivable explanation of this last observation is that the single specimen which Clark examined was preserved in some fluid which dissolved away many of the calcareous deposits. A fact which lends support to this theory is that his specimen had turned

* Zeitschr. für Wiss., Zoologie, vol. xxxv. (1881).

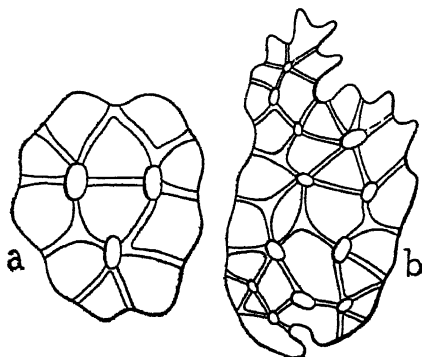
completely white, and had entirely lost its spots, within a year from the time it was put in the bottle. My specimens retain their spots in 75 % alcohol ten months after being bottled, and, if anything, these are darker than in life. Finally, while both Selenka and Ludwig find five prominent anal teeth on their specimens, there are none on any of the specimens before me.

I take great pleasure in naming this species after Dr. W. K. Fisher, Director of the Hopkins Marine Station of Stanford University.

Cucumaria fisheri, forma *astigmata*, forma nov.

Description.—Tentacles 10, dendroid, equal in size in adult specimens. Length of largest adult in life 50 mm. ;

Fig. 2.



Cucumaria fisheri, forma *astigmata*, nov. a, small 3-holed button ;
b, medium-sized spiny button.

width 9 mm. ; length of same specimen in alcohol 41 mm. Colour in life orange-yellow, without spots of any kind ; in alcohol dirty white. The pedicels are in a double row on each ambulacrum, but are also scattered on the interambulacra in all specimens. Five small anal papillæ terminate the ambulacra. The retractor muscles join the longitudinal muscles at a point slightly less than two-thirds the length of the animal, measuring from the anterior end. Respiratory trees 2. Polian vesicle 1, about 6 mm. long, on the left of the median dorsal ambulacrum. Stone-canal 1, the madreporic body being imbedded in the dorsal

mesentery to the right of the median dorsal ambulacrum. Calcareous deposits: identical with those of *Cucumaria fisheri*, forma *fisheri*.

Type.—The type will be deposited in the U.S. National Museum; paratypes in the British Museum (Natural History), Museum of Comparative Zoology, and in the Zoological Collections of Stanford University.

Specimens examined.—Forty-four, low tide, at 1 fathom, and 12 fathoms on *Macrocystis* "hold-fasts," and on fenestrated shale, off Monterey and Cabrillo Point, Pacific Grove.

Discussion.—As will be seen by a comparison of their respective descriptions, this variety differs from *C. fisheri* in two points only. These are constant differences, however. First, typical *fisheri* is yellow with many brown spots or "freckles"; forma *astigmata* is yellow-orange in colour and has no spots whatever. Secondly, *fisheri* has no pedicels on the interambulacra; *astigmata* has pedicels on the interambulacra.

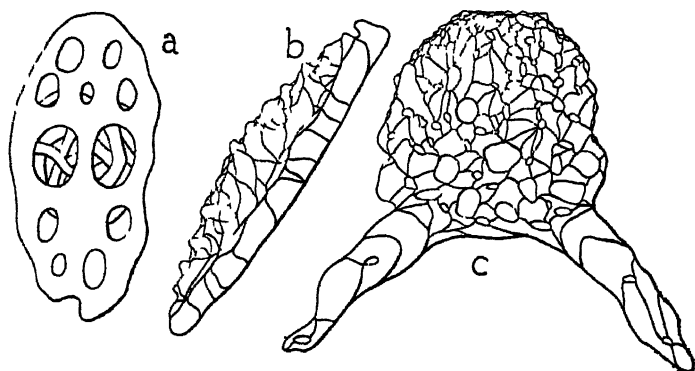
Clark (*loc. cit.* 1901) received what were doubtless a few very young specimens of this variety from Pacific Grove, and thought that they might possibly be *C. miniata*, Brandt. Quoting from his description: "All of the remaining specimens are small white Cucumarias, the largest 24 mm. long. The largest one is said to have been pinkish in life, with pink tentacles. Besides the double row of pedicels on the ambulacra, these specimens all have scattered pedicels on the interambulacra. The calcareous deposits consist of very numerous, thick, knobbed lenticular buttons, with about 12 perforations; and most of them have one end drawn out as a spiny projection. These deposits resemble those of *C. leonina*, Semper, and consequently I am inclined to think that these 5 specimens from Pacific Grove represent Brandt's species *miniata*, which according to Ludwig has deposits like *leonina*. But the presence of interambulacral pedicels makes me doubtful. If these are *miniata*, and the large one previously reported is *albida*, Selenka, as seems probable, then Ludwig is wrong in supposing them to be identical. If these specimens are not *miniata*, they probably represent a new species."

The similarity of the calcareous deposits of this variety to those of *C. leonina*, Semper, has previously been mentioned. In no other respect are these specimens similar to *C. miniata*, Brandt, as was shown in the foregoing description of *C. fisheri*.

Cucumaria cosmotyrsitus, sp. n.

Description.—Tentacles 10, dendroid, the two ventral smaller. Length in life of largest specimen 29 mm.; length of same specimen in alcohol 26 mm.; width in life 6 mm.; width in alcohol 4.5 mm. Colour in life white; in alcohol a dirty white. Pedicels rather long for the size of the animal and in a double row on each ambulacrum. There are no pedicels on any of the interambulacra. The retractor muscles are well developed, as two of my specimens are strongly contracted. They are given off from the longitudinal muscles at a point about

Fig. 3.



Cucumaria cosmotyrsitus, sp. n. a, disk of medium-sized table, showing the two parallel central holes; b, table, edge view; c, supporting rod, showing the characteristic large ornate tower.

two-thirds the length of the animal, measuring from the anterior end. Polian vesicle 1, short, vesicular. Stone-canal 1, minute. Calcareous deposits: many knobbed tables, with two large parallel holes in the middle of the disk and supporting rods—the latter with large ornate towers.

Type.—Will be deposited in the U.S. National Museum; paratypes in the Zoological Collections, Stanford University.

Specimens examined.—Three, off Monterey, fenestrated shale, 12 fathoms; Cabrillo Point, 1 fathom, *Macrocystis* "hold-fasts."

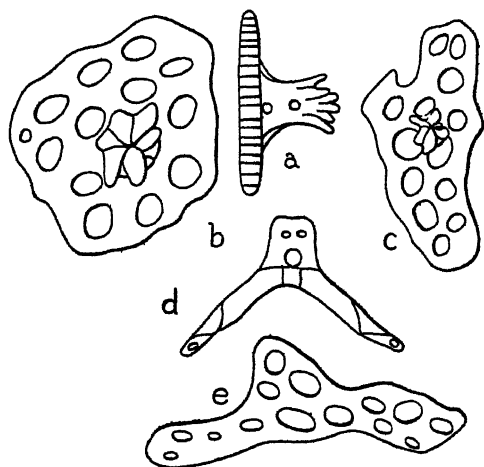
Discussion.—Only one live specimen was observed. It

was taken from the hold-fasts of *Macrocystis pyrifera*, a giant kelp, pulled up from the sandy bottom of Station Cove. The pedicels, as noted above, were long in life. The specimen is about the same size as *C. longipeda*, Semper, but otherwise differs markedly from that Holothurian. The calcareous deposits are unique, and I have derived the specific name from the characteristic ornate tower of the supporting rods.

Cucumaria tenuicoriata, sp. n.

Description.—Tentacles 10, dendroid, the two ventral smaller. Length of largest specimen in alcohol 34 mm. ;

Fig. 4.



Cucumaria tenuicoriata, sp. n. a, lateral view of table, showing tower ; b, c, tables with small towers ; d, supporting rod ; e, irregular perforated plate.

width in alcohol 6 mm. Colour in alcohol white. Length, width, and colour in life unknown. The pedicels are small and scattered. They are situated in a double row on each of the ambulacra. There are no pedicels on the thin wide ambulacra. The skin is soft to the touch and very thin, but contains abundant calcareous deposits. Anal teeth or papillæ lacking. The retractor muscles, which are well developed, join the longitudinal muscles at about the middle of the body. The respiratory trees and the posterior end

of the alimentary canal have been evaginated in both my specimens. Polian vesicle 1, ventral and vesicular. It is about 4 mm. in length. Stone-canal and madreporic plate single and minute. Calcareous deposits: nearly all are tables with more or less rounded disk and low spire. Supporting rods are present; these are raised in a simple tower. A few scattered perforated irregular plates are also present. These have no spires. All have smooth margins and are very small in size.

Although naturally hesitant in basing a new species upon but two individuals, I am unable to place them with any of the species now known. The specific name is derived from the characteristic thin delicate nature of the body-wall.

Type.—Will be deposited in the U.S. National Museum; paratype in the Zoological Collections of Stanford University.

Specimens examined.—Two, off Monterey, 12 fathoms.

EXPLANATION OF PLATE III.

Fig. 1. Cucumaria fisheri.

Fig. 2. Cucumaria fisheri, forma astigmata.

Fig. 3. Cucumaria cosmotyritus.

Fig. 4. Cucumaria tenuicoriata.

All $1\frac{1}{2}$ natural size.

V.—*Some Decapod Crustaceans (Callianassa and Ranina) from the Oligocene of Washington State, U.S.A.* By THOMAS H. WITHERS, F.G.S.

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[Plate IV.]

AMONG the foreign collection of fossil Decapods in the Geological Department of the British Museum is a small suite of eleven specimens from Clallam Bay, Washington State, U.S.A. These were obtained from Dr. Robt. Brown in 1868. Ten specimens are referable to a single new species of *Callianassa* (*C. clallamensis*). A species of *Callianassa* (*C. oregonensis*) has been described by J. D. Dana (1849) from the neighbouring state of Oregon, but the present specimens evidently do not belong to it. The eleventh specimen represents a new species of *Ranina* (*R. americana*). This is of importance, since with the exception of a *Ranina*

from the Eocene (Tejon formation) of California, figured without description under the name of *Cancer* (?), sp. *b*, by Dickerson, 1916, Univ. Calif. Publ. Geol. vol. ix. p. 427, pl. xlii. fig. 12 (ventral view), no fossil species of *Ranina* has been made known from either North or South America. All the specimens of *Callianassa* are enclosed in nodules, but the *Ranina* does not appear to have been enclosed in a nodule and is in a different matrix.

Clallam Bay is near the western extremity of Washington State on the south shore of the Strait of St. Juan de Fuca, south of Vancouver Island. The occurrence of fossil Decapod Crustaceans in this neighbourhood is not unknown, for C. E. Weaver (1912, "A Preliminary Report on the Tertiary Palæontology of Western Washington," Bull. No. 15, Washington Geol. Surv. p. 80) states:—"Certain portions of the Blakeley formation are characterized by hard flinty semi-calcareous concretions which, when cracked open nearly always contain the fossil remains of crabs. Many of these are well-preserved. They occur most abundantly in the shale bluffs at Porter, Chehalis County and in the northern part of the Pacific County, north of the town of Menlo." The Blakeley formation of Western Washington was referred (p. 11) to the Lower Miocene. In a later paper, C. E. Weaver (1916, "The Tertiary Formations of Western Washington," Bull. No. 13, Washington Geol. Surv. p. 81), considered the Blakeley formation to be of Upper Oligocene age, and it is said to be characterized by the Pelecypod *Acila gettysburgensis*, Reagan.

Family Callianassidæ.

Genus CALLIANASSA, Leach, 1814.

Callianassa clallamensis, sp. n. (Pl. IV. figs. 4-7.)

Distribution.—Upper Oligocene (Blakeley formation): Clallam Bay, south shore of Strait of Juan de Fuca, Washington State, U.S.A.

Material.—Ten specimens (one a counterpart) in the Geological Department of the British Museum, registered In. 23789—In. 23797.

Holotype.—A left cheliped (Pl. IV. fig. 4), Brit. Mus., In. 23789.

Description.—All the specimens are in nodules, which are intensely hard; consequently the matrix is difficult to remove. The surface of the specimens, however, is hard and well-preserved, but very liable to flake off under

pre-sure. Judging from these few specimens, the whole cheliped is frequently preserved. In each specimen only the outer or inner surface is exposed, and, since none is quite complete, several specimens are necessary to gain an idea of the structure of the species.

Hand quadrate, length exceeding the height, with a small spine at the outer margin of the sinus between the fingers. Upper and lower margins almost parallel, slightly converging distally. Upper margin slightly convex, lower margin very slightly sinuous; both margins have the edge slightly raised to form a thin smooth rim on the outer surface (Pl. IV. fig. 6). Possibly the lower edge is serrated on the inner face, but only one specimen shows the inner surface, and this has the lower border broken. Outer surface moderately convex longitudinally, with a row of minute circular sockets (possibly six) extending close up against the rim of the upper margin. A further row of somewhat longitudinally elongate tubercles, on the distal side of which are oval sockets, is situated a little above the rim on the lower margin; these tubercles become smaller or die out on the proximal half of the hand. An irregular group of comparatively large, widely spaced, longitudinally elongate tubercles, becoming larger distally, is situated on the lower distal half of the hand, near to the sinus between the fingers, and a single tubercle is apart from this group in the middle of the hand; on the distal side of these tubercles are elongate sockets. There is a small group of smaller tubercles, variable in number in the several specimens, near to the distal extremity at the upper margin.

Inner surface of hand apparently smooth, except for a small tubercle near the middle of the hand, a short vertical row of three to four close minute tubercles near to the distal extremity at the upper margin, and a similar vertical row of tubercles, not so closely disposed, near to the lateral articulation with the dactylus. The upper distal extremity of the hand is produced into a somewhat prominent node. Immobile finger outwardly convex, with a low wide tooth near to the middle of the finger on its upper (outer) margin, and a prominent sharp ridge extends along the middle of the finger and dies out between, but nearer to the upper one of two tubercles at the base of the finger (Pl. IV. fig. 6). The inner face of the finger is not exposed in any of the specimens.

Dactylus somewhat arcuate, triangular in transverse section, with the upper face wide and concave, the outer face convex, and the inner face generally concave. Upper surface

with three unequal low nodes near the proximal end. Outer margin of upper surface tuberculated at its proximal end, the tubercles being small, and forming two close and somewhat alternating rows (Pl. IV. fig. 5). Below the tubercles the surface is somewhat smooth and flattened, and the lower part is thrown into a row of irregular nodes. Inner face (Pl. IV. fig. 7) with the proximal end of the upper margin having two small tubercles. A prominent sharp ridge extends obliquely from the lower basal end to the finger tip; it emerges from a small rounded group of tubercles towards the base of the finger, and the base of the ridge itself is formed of a single line of five close tubercles. A single tubercle is seen in the middle of the finger above the ridge. Below the ridge the finger is steeply inclined downwards and forms a long low tooth.

Carpus much shorter than the hand in length, upper margin nearly straight, the lower margin curving upwards to the proximal end; apparently the upper and lower margins on the outer face have a rim as on the hand.

Merus about the same length as the carpus, very much narrower, upper margin convex, lower margin concave, the surface sharply and transversely ridged one-third the width of the lower margin, and the lower proximal corner produced into a sharp spine.

Remarks.—J. D. Dana (1849, Wilkes U.S. Explor. Exped. vol. x. p. 722, pl. xvii. fig. 3) described a species of *Callianassa* (*C. oregonensis*) from "Calcareous concretions of the argillaceous rock," said to be of Miocene age, near Astoria, Oregon. The type is a cheliped evidently exhibiting the inner surface, and the joints of the leg are said to be smooth. Judging from his figure, which is said to be of natural size, his measurement of $\frac{3}{4}$ inches for the length of the hand, includes the fingers. Actually the figure shows that the hand is shorter than the carpus, and not of the same length.

The present specimens differ at once from *C. oregonensis* in having a very much shorter carpus, for the hand is twice the length of the carpus. Only one specimen (Pl. IV. fig. 7) shows the inner surface, and this agrees with the type of *C. oregonensis* in being smooth, except that it has a single small tubercle in the middle of the hand; its lower margin is broken, so that it cannot be seen whether it was serrated as in *C. oregonensis*.

Callianassa clallamensis is evidently allied to *C. spinulosa*, Rathbun (1918, Bull. 103, U.S. Nat. Mus. p. 143, pl. lxi. figs. 6-9), from the Oligocene (in nodules) of the Panama

Canal Zone. The carpus, merus, and dactylus of *C. spinulosa* are not known, but the hand differs in being shorter in comparison with the height, the upper and lower margins are more convergent distally, and the tubercles on the lower distal half of the hand are more densely disposed. The two species agree in having a small spine between the fingers.

Family Raninidæ.

Genus RANINA, Lamarck, 1801.

The genus has been found in the Cretaceous (Cenomanian) and Tertiary (Eocene to Miocene) of Europe and in the Tertiary of India and Borneo, and occurs isolated in the Tertiary of Trinidad. Its discovery in the Tertiary of the western side of North America considerably extends its known geographical range. Only a single species, *Ranina ranina* (Linnæus), is found living, and this is confined to the Indo-Pacific region.

Fabiani (1910, Atti Acc. sci. veneto-trentino-istriani, ser. 3, tom. iii. p. 85) has divided the species of *Ranina* into two groups, namely, *Lophoranina* (type, *R. marestiana*, Koenig) and *Eteroranina* (type, *R. dentata*, Latreille, = *R. ranina* (Linnæus)). The species *R. americana*, sp. n., belongs to the latter group, which, however, should be called *Ranina*, s. str. Since the Tertiary species from Trinidad, India, and Ceylon belong to *Lophoranina*, *R. americana*, sp. n., assumes further importance as being the first-described fossil species of *Ranina*, s. str., occurring outside Europe.

Ranina americana, sp. n. (Pl. IV. figs. 1-3.)

Diagnosis.—A *Ranina* with the outer surface of the cephalothorax smooth, except for the sides on the anterior half, where the surface is marked with semicircular incisions, behind which the surface is raised and the edge finely toothed; these markings are somewhat coarser anteriorly. First sternite widely trifid, the episternum with the anterior margins forming an obtuse angle and the posterior margins obliquely inclined outwards.

Distribution.—Upper Oligocene (Blakeley formation), in a matrix of greenish-grey sandstone: Clallam Bay, south shore of Strait of Juan de Fuca, Washington State, U.S.A.

Holotype.—A single imperfect cephalothorax in the Geological Department of the British Museum, registered Lu. 23798. Obtained from Dr. Robt. Brown, 1868.

Description.—Cephalothorax elongate-ovoid, moderately convex transversely, width of orbito-frontal margin about equal to half that of the carapace. Length, imperfect, 60 mm.; breadth 48 mm. Antero-lateral margins with three large lobes, very narrowly and deeply separated. The anterior lobe on the left side is the only one preserved entire, and this has a broadly rounded margin; the middle lobe is of about the same width, but evidently projected beyond the others; the third and posterior lobe being small and projected only to a small extent. The postero-lateral margins converge posteriorly, are slightly raised to form a rim, which is weakly serrated above. The orbito-frontal margin is broken away, but on the right side is an impression of the eye-stalk and on the left the eye-stalk itself. Outer surface smooth except on the sides of the anterior half of the carapace, where there are semicircular incisions, behind which the surface is raised and the edges slightly toothed; these markings are somewhat coarser anteriorly. On the inner surface only the anterior half of the specimen is preserved, and the pterygostomian plates, the third maxillipedes, and the first sternal plate are displaced. Pterygostomian plates extremely convex, with the sides bordering the buccal cavity slightly excavated, and below there is a small rounded excavation for the basal joint of the third maxillipedes; the inner half of the surface is smooth and minutely pitted, and the outer half is coarsely ornamented with raised scale-like markings, toothed on the anterior edge, and these markings become more closely disposed towards the outer margin. Third maxillipedes much elongated. First sternite widely trifid, with the outer lobes widely rounded, wider than the middle lobe or episternum; the sides curve downward and become subparallel. Surface of first sternite marked by a number of pits, forming an almost symmetrical pattern (see Pl. IV. fig. 3). Episternum with the anterior margins forming an obtuse angle and the posterior margins slightly inclined outwards. Branchiostegite with the buccal margin sinuous, obliquely inclined outwards, and the margin adjoining the pterygostomian plate bordered by a close line of pits; the middle of the plate is raised to form a ridge, steep-sided and somewhat concave on the outer side, where there are a number of coarse but small scale-like markings. A few similar, but smaller, markings are situated near to the buccal margin.

Remarks.—This species evidently approaches *R. granulosa*, Milne-Edwards (1872, Ann. Sci. Geol. iii. Art. 3, p. 5, pl. viii.), from the Miocene, near Dax, Gironde, France.

R. granulosa, however, has the outer surface of the cephalothorax entirely granulate, thus differing much in type of ornament. While the lobes on the antero-lateral margins are very similar, they have wider interspaces; and of the sternal plates the episternum has more curved sides, which is quite different from *R. americana*, in which the margins are straight.

EXPLANATION OF PLATE IV.

Ranina americana, sp. n.

- Fig. 1.* Cephalothorax. Outer view. Holotype. Brit. Mus., In. 23798.
Nat. size.
Fig. 2. Left side view of same.
Fig. 3. Ventral view of same.

Callianassa clallamensis, sp. n.

- Fig. 4.* Left cheliped (propodus, carpus, and merus). Outer view. Holotype. Brit. Mus., In. 23789.
Fig. 5. Right cheliped (propodus and dactylus). Outer view. Brit. Mus., In. 23790.
Fig. 6. Right cheliped (propodus, carpus, and base of dactylus). Outer view. Brit. Mus., In. 23791.
Fig. 7. Left cheliped (carpus, propodus with immovable finger broken off, and dactylus). Inner view. Brit. Mus., In. 23792.

All figures nat. size.

VI.—*Note on a new Cephalopod*, *Cirroteuthis* (*Cirroteuthopsis*) *massyæ*, *Grimpe*. By ANNE L. MASSY.

IN 1907, having just begun to study that fascinating group, the Cephalopoda, I took advantage of a visit of Dr. Hoyle to Dublin to obtain his opinion on a handsome specimen of *Cirroteuthis*, which had been trawled during investigations carried out by the Fisheries Branch of the Department of Agriculture and Technical Instruction for Ireland (now the Ministry of Fisheries), in 50° 31' N., 11° 31' W., at soundings of 670–770 fathoms*. He advised me to refer it "with some reservation to *Cirroteuthis umbellata*, P. Fischer." The known examples of this family are few in number, and very much alike. Some were, moreover, obtained in very bad condition; and others have been insufficiently described.

* Fisheries, Ireland Sci. Invest. 1907, i. [1909].

A difference in the shape of the cartilage, which supports the fins, led Hoyle* to separate those having more or less horseshoe-shaped cartilages to the genus *Stauroteuthis*, while for those in which the cartilage was somewhat saddle-shaped he retained the name of *Cirroteuthis*.

Grimpe† supports the view of Hoyle, and considers that "*Cirroteuthis*" *umbellata* should be called *Stauroteuthis umbellata* on account of its having a horseshoe-shaped cartilage. As the Irish example referred to above has a saddle-shaped cartilage at the posterior end of the body, it is evident that it is a different species to *C. umbellata*.

Furthermore, on account of a peculiar arrangement of the cirri, which appear to be placed on a line with the suckers, instead of alternating with them, Grimpe, *op. cit.*, considers that it should be separated as a subgenus; and gives it the name of *Cirroteuthis* (*Cirroteuthopsis*) *massyæ*. The specimen is preserved in the National Museum, Dublin, where Mr. Nichols and I have recently re-examined it. On all the arms which we could conveniently see the cirri appear to be usually on a line with the central cup of the sucker, occasionally they are on a line with the posterior edge of the sucker, but none appeared to be lower than that level. Whether the cirri occupied this position in life, or whether their unusual situation is caused by possible spreading of the soft tissues produced by the specimen having been placed in 5 per cent. formalin, is a question which can hardly be definitely settled in the case of a single individual.

Therefore, for the present, it would seem to be necessary to exercise caution as to the exact status of this example. Possibly the young *Cirroteuthis* previously recorded from the Irish coast‡, and the young specimen taken off the coast of France, and provisionally named *C. caudani*, Joubin, and the present example, all belong to the same species.

It should, however, be remembered that *C. umbellata*, Fischer, and *C. megaptera*, Verrill, have both been recorded also from this part of the Atlantic§.

C. mülleri, Eschr., would seem to be restricted, as far as our present knowledge goes, entirely to Arctic regions.

It would be quite possible, however, for such a deep-water species to extend its southern limit to S.W. Ireland.

Besides the position of the cirri, the chief differences between *C. mülleri* and the species under consideration are

* Bull. Mus. Comp. Zool. Harv. Coll. xliii. 1904, p. 3.

† Zool. Anzeiger, Bd. li. No. 11, Sept. 1920.

‡ Hoyle, Ann. Rep. Fish., Ireland, 1902-3, Pt. ii. App. iii. [1905].

§ Joubin, Ann. Univ. Lyon, vol. xxvi. p. 247, 1896.

that in *C. massyæ* the dorsal arms are enormously developed and the umbrella reaches higher on them than on the lateral and ventral arms. The first of these differences is very probably due to sex-dimorphism.

The figure of *C. mülleri* given by Eschricht, and reproduced by Pfeffer*, if correct, shows that an important difference exists in the position of the fins, as these, in *C. massyæ*, are placed much nearer the end of the body.

I am indebted to M. Joubin for most kindly having a complete copy of his paper on *C. caudani*† typed for me, including a tracing of the drawing, as I was unable to obtain access to the paper in Dublin.

C. caudani was in very bad condition, and was characterized by enormous eyes, and a very broad short body with small fins, placed quite posteriorly. The cirri were excessively short and appeared to alternate with the suckers.

The cartilage is not mentioned, probably owing to the very small size of the specimen. In the figure, which is very slightly enlarged, the breadth of the body is 30 mm. Of this space 20 mm. is occupied by the eyes. The total length, if the arms were un mutilated, would probably be about 95 mm.

Grimpe, *op. cit.*, p. 232, attaches great importance to the shape of the cartilage supporting the fins. In actual practice the difference between a horseshoe or a saddle-shaped cartilage, felt through the skin, as it usually has to be on account of the rarity of the specimens, is not at all easy to recognize. As M. Joubin‡ remarks: "Ce caractère est très difficile à constater avec précision puisque l'on n'a généralement qu'un ou deux échantillons qu'on ne peut disséquer. En outre il faudra voir plus tard, lorsqu'on aura pu examiner un plus grand nombre d'individus, jusqu'à quel point ce caractère est fixe; enfin ces Céphalopodes sont si semblables entre eux, tous leurs autres caractères diffèrent si peu, sauf celui-là, qu'il n'y a vraiment pas là matière à justifier une division de l'ancien genre *Cirroteuthis* en deux genres *Stauroteuthis* et *Cirroteuthis* sensu stricto. . . . Je dois avouer que je n'attache pas à la forme de ce cartilage une importance assez grande pour en faire le critérium de la distinction des deux genres. Dans les deux cas il est un demi-cercle, aplati et dilaté chez l'un, en demi-anneau chez l'autre. Ce sont les différences tout au plus spécifiques et qui vraisemblablement perdront

* 'Nordisches Plankton,' IV. Cephalopoden, Leipzig, 1908, p. 23.

† Ann. Univ. Lyon, vol. xxvi. p. 247, 1896.

‡ Res. Camp. Sci. Albert, 1^{er} fasc. liv. 1920, pp. 14-15 and 21.

tout caractère d'exclusivité quand on aura, sur de plus nombreux documents, constaté des formes intermédiaires." Hoyle * has, moreover, observed with regard to *Cirroteuthis meangensis*, Hoyle: "I found a young individual with the cartilage disposed as in *Stauroteuthis*, while in a larger one it was placed in the usual manner."

This observation suggested the idea that possibly the cartilage might be horseshoe-shaped in young individuals, and gradually become saddle-shaped.

An examination of the lengths given for a number of species of which the descriptions were available to me showed, however, that this is not the case. Some species described as having a horseshoe-shaped cartilage possessed a total length varying from 130-500 mm., while examples with saddle-shaped cartilage had a total length of 99-1155 mm. Until a very much larger number of individuals of this interesting family are available for examination, so that specimens of all sizes may be sacrificed partially in order to have the cartilage figured, this question as to whether the cartilage is of generic importance cannot, it would seem, be definitely decided.

VII.—*Descriptions of new African Rhopalocera.*

By G. T. BETHUNE-BAKER, F.L.S., F.Z.S.

Alana bicolora, sp. n.

♂ and ♀. Upperside: both wings ochraceous yellow, base for a restricted area black. The primaries have the costa broadly and termen very broadly black; the black costa does not fill the entire cell and is invaded beyond the cell by the yellow ground-colour; the cell is closed by a black patch confluent with the costa; the black termen is inwardly concave. Secondaries similar to the primaries.

Underside: both wings with the yellow area, which is paler and specially so in the secondaries, similar to the upperside; the cells are closed by black dashes, and the black termen is invaded by a marginal row on the inner edge of pale yellowish internervular spots, and the yellow fringes are invaded along the veins by prominent blackish dashes in each wing.

* 'Challenger' Exp. Rept. on the Cephalopoda, Zool. vol. xvi. 1886, p. 61.

Expanse, ♂ 24-26, ♀ 28 mm.

Hab. Usangu district (*Neave*), one ♂. Kongwa, Dar es Salaam, 7 ♂♂ and 1 ♀.

Type, ♂, in the British Museum; type, ♀, in the Hope Museum, Oxford, with seven males, all from Kongwa, Dar es Salaam (*K. St. A. Rogers*).

This is a pretty little species near *aurantiaca*, Butler.

Epamera berbera, sp. n.

♀. Upperside: both wings pale bluish, not bright; in the primaries extending over all the cell and from there nearly to the tornus; in the secondaries over the cell and right along vein 6 nearly to the termen; the rest of the wings blackish.

Underside: both wings dark, dull ashy brown. Primaries with a dark dash closing the cell, a dark postmedian stripe abruptly broken and shifted outwards below vein 5, a dark slightly curved submarginal line; termen very finely dark. Secondaries with an irregular dark dash closing the cell, above which near the origin of vein 7 rises another irregular dark dash to vein 8; a very irregular postmedian line, broken and shifted outwards at veins 6, 5, 4, but at vein 3 shifted well inwards, from whence the line extends in an acute angle outwards into the middle of the fold, and then runs irregularly to the inner margin; a black terminal spot below vein 3, and another black spot with slight metallic scaling at the anal angle on the slight lobe beyond the tail. All the dark dashes and lines have a certain amount of orange scaling visible in a strong light.

Expanse 39 mm.

Hab. Berbera (Somaliland), *H. A. Byatt*.

Type in the British Museum. 1 ♀.

This is so very distinct an insect on the underside that I do not hesitate to describe it.

Hypolycæna buxtoni rogersi, forma nov.

♂. Both wings uniform, exceedingly dark purplish colour. Primaries with similarly coloured fringes, secondaries with white fringes and with a red lobe spot with blue metallic scaling.

Underside: both wings white, very slightly dusky in the apical and terminal area of the primaries. Primaries with a fine reddish-orange dash closing the cell, a sharply-defined orange postmedian line indented inwards below the costa,

a finer greyer subterminal line well curved inwards below the costa. Secondaries with a bright reddish subbasal spot below the costa, an exceedingly fine line closing the cell; postmedian line as in the primaries, but rather crenulate, with an acute angle in the fold, and then ascending to the inner margin; subterminal line like the primaries, but curving round in the fold up to the termen; a terminal dark line terminating in the upper black spot, which has an orange inner edge, and with a black and orange lobe-spot; between these two spots is some metallic-blue scaling.

♀. Upperside: both wings brown, with a large white patch in the postmedian area of each wing. Secondaries with a brown postmedian line angled on the fold, a broad subterminal line following the contour of the wings, a terminal stripe ending at the upper dark spot, between which and the other black spot is a suffusion of orange colour; lobe-spot orange-colour, with fine black external edging.

Underside as in the male.

Expanse, ♂ 38, ♀ 36 mm.

Hab. Rabai, Mombasa (*K. St. A. Rogers*).

Types in the Hope Collection. A series.

EICOCHRYSOPS, gen. nov.

Primaries: wings broad, costa moderately arched, termen less arched; secondaries moderately evenly rounded. Head small, eyes glabrous; antennæ fine, with a longish club, not spatulate. Neuration: primaries, cell longish; vein 2 from beyond its centre, 3 from before the lower angle, 4 from the angle, 5 from the middle of the cell, 6 from the upper angle, 7 from well behind the angle, 8 branched with 7 on a long stalk, 9 absent, 10 from a third from end of cell, 11 bent up to 12, but not actually touching it. Secondaries 2 from the middle of the cell, 3 and 4 from the lower angle, 5 from the middle, 7 from beyond the middle, slightly curved towards costa at the base and long.

The genitalia of the male have the tegumen large and specialized, the harpagines (clasps) are similar in shape to the long arm-like organ in most *Catochrysops*, but the furca is quite free—a mere bifurcate sclerite with no anellus.

Type, *Eicochrysops eicotrochilus*.

Eicochrysops eicotrochilus, sp. n.

♂ and ♀. Upperside: both wings uniform, warm brown, slightly tawny in shade. In the secondaries there is a

black subanal terminal black spot, with a smaller and less distinct one beyond it edged broadly internally with orange yellow.

Underside: both wings pale grey, with rather darker spots palely encircled. Primaries with a dash closing the cell; a postmedian row (placed well outwards) of six small spots, that below the costa being placed well inwards, the second, third, and fourth below each other, the fifth shifted slightly inwards, the sixth in line with the aforesaid three; an indefinite row of terminal small spots, broadly encircled with whitish grey. Secondaries with three subbasal blackish dots below each other, the third on the inner margin, which has a very small one above it on the inner margin; a fifth blackish spot near the apex, and immediately below it is a grey spot, which is really the first spot of the postmedian row, but it is separated so much from it that it is better to mention it here; cell closed by a dash; postmedian row, in addition to the one mentioned, consists of six spots, two below vein 6, the next one shifted inwards, the following one shifted further in, that below vein 2 shifted outwards, and the last well inwards on the inner margin; a row of subterminal darker dashes followed by a terminal row of subapical spots; a subanal black spot edged internally with orange-yellow, which extends into the next neural interspace.

Expanse, ♂ 25-26, ♀ 22-25 mm.

Hab. Fort Jameson, N.E. Rhodesia (*Langshaw*); Ndarugu, Tanganyika District (*Feather*); Salisbury, Mashonaland (*G. A. K. Marshall*); N.E. Rhodesia (*Neave*).

Types in my collection. A series.

This species has hitherto been mixed up with *mahallakoena*, and is no doubt represented in many collections as its female; when, however, I monographed the genus *Catochrysops*, as represented by *Aurivillius* in his fifteenth group of *Cupido*, I found out the error, and that we had another species with both sexes alike. It is very widely spread on the east side of Africa, occurring up to Nairobi, if not beyond.

Both *messapus* and *mahallakoena*, and also *nandiana*, should be placed in this genus, their genitalia and general pattern being similar.

Eicochrysops rogersi, sp. n.

♂. Upperside: both wings dull violet-blue, with the termen rather broadly brown; in the secondaries there is a black subanal terminal spot.

Underside: both wings pale stone-grey, with darker spots palely encircled. Primaries with a black dash closing the cell; the postmedian row consists of six spots highly ex-curved in the radial area, the second, third, and fourth spots shifted well outwards, the third spot being placed slightly obliquely, fifth spot shifted well inwards, sixth underneath it on its outer half; a trace of a subterminal darkish grey row of dashes followed by a fainter trace of paler terminal dashes in a whitish-grey area. Secondaries with three very small blackish subbasal spots well separated below each other, the third on the inner margin having another above it also on the inner margin; a fifth blackish dot is shifted well outwards below vein 8, cell closed by a pale dash; the postmedian row consists of five spots scarcely darker than the ground-colour, the first three adjoining in a slight curve below vein 6, the fourth shifted inwards, and the fifth outwards; a subterminal row of dashes followed by a terminal row in a pale area; a small black subanal terminal spot with a small internal orange-coloured edging. All the spots of the secondaries are faint and not easy to see.

♀. Upperside: both wings brown, with a very restricted basal area of dark bluish superimposed scales, otherwise as in the male, except that the postmedian row of the secondaries has six spots instead of five, there being an additional spot above vein 6.

Expanse, ♂ 21-25, ♀ 25 mm.

Hab. Rabete, Kenya Colony, January 1921 (*K. St. A. Rogers*), 4 ♂, 2 ♀. 1 ♂, Tongido, E. Africa.

Types in the Hope Museum, Oxford.

This species is quite distinct from its other allies in colour and pattern; the shape and prominence of the postmedian row in the primaries place it next to *eicotrochylus*.

Zeritis neriene muzizii, forma nov.

♂. Differs from the type-form on the upperside in that it is less black. The underside is very different in colour; though the pattern is similar, the black edging of spots and on the veins of the type is almost quite obsolescent; the ochreous spots of the type are replaced by a soft ash-grey, which gives quite a different appearance to the insect; the metallic markings of the type-form are in the primaries much reduced and in the secondaries are almost quite absent.

In one darker specimen the absence of black above and below is not quite so pronounced.

Hab. Muzizi Forest, S. end of Lake Albert, S.E. Africa.
Types in the Hope Museum, Oxford. 2 ♂ ♂.

EGUMBIA, gen. nov.

♀. Primaries triangular, broad; costa arched at base, then straight to near apex; termen very slightly arched. Secondaries smallish for the size of the insect, subtriangular. Thorax and abdomen robust. Head small, eyes glabrous, antennæ shortish to about the middle of the costa.

Neuration: primaries, cell reaching to about half the length of the wing; vein 2 from beyond the centre of the cell, 3 from well before the angle, 4 from the lower angle, 5 from the middle of the discocellulars, 6 from the upper angle of the cell, 7 from the apex of the cell, 8 and 9 both stalked with 7 on longish stalks, 10 from a third before apex, 11 from before the middle of the cell. Secondaries with cell broad, not quite half the length of the wing; vein 2 from well beyond the middle of the cell, 3 from just before the lower angle, 4 from the lower angle, 5 from near the centre of the discocellulars, 7 from well behind the upper angle, 8 highly upcurved and long.

Type, *Egumbia catori*, B.-B.

Egumbia catori, sp. n.

♀. Upperside: both wings blackish brown, with pale bluish patches. Primaries with a silvery-blue patch to a little beyond the cell, not reaching into the tornus. Secondaries with the patch more extensive, reaching to vein 6 and nearly into the anal angle, leaving a broad dark terminal border; no lobe and the termen very slightly scalloped.

Underside: both wings pure snowy white entirely markless, the only mark being black points at the end of each vein, which show more prominently in the secondaries than in the primaries.

Expanse 45-48 mm.

Hab. Egumbe, Kabba Province, N. Nigeria, September (Cator).

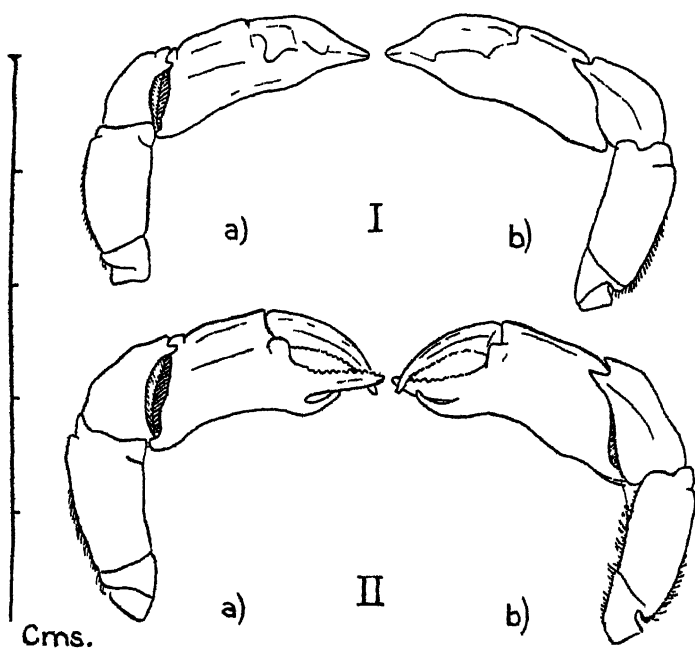
Type in Cator's collection. 2 ♀ ♀.

This genus should be included in the *Epitolinæ*.

VIII.—*Two Abnormal Chelæ of Carcinus mœnas, Pennant.*

By MICHAEL PERKINS, B.A., F.E.S. (Coutts-Trotter Student and Scholar of Trinity College, Cambridge, and Trotman Exhibitioner of the Worshipful Company of Haberdashers).

THE two abnormal chelæ here described were found among 661 specimens of *Carcinus mœnas*, Pennant, which were examined at the mouth of the Exe Estuary in March 1924; they are the first that have come under my notice among



approximately 2500 British *Carcinus* whose chelæ I have examined. One of these is a deformed chela of a kind which seems not to have been reported up to the present date, the other is a teratological type which has not been found in *Carcinus* hitherto, though it is known in other Brachyura.

Figs. I. *a* & *b* represent the outer and inner surfaces respectively of a chela whose indices are completely grown

together and fused; the fused points are attenuated in a manner which suggests that they have been trapped together, *e. g.*, in a closed bivalve shell. The opposed surfaces of the indices are crushed together and explanate, indicating that some sort of separation of the outer and the inner surfaces along the mid-line of each has occurred.

The deformity may have resulted from a crushing together of the indices, so that the flesh of each was laid bare on the opposing surfaces and subsequently grew together, but it is evident from the uniform continuity of the chitin surface that at least one moult has taken place since the injury was experienced. Hence it is difficult to understand why the deformity has been confirmed and why no regenerative restitution towards the normal shape has taken place, particularly since Przibram* has observed autotomy of badly regenerated appendages of Crustacea. I have a male specimen of *Carcinus* from the same locality, infested by *Portunion*, exhibiting an old cut on the outer surface of the merus of the left chela which has been restored by chitini-sation of the exposed soft tissue instead of by the usual processes of autotomy and regeneration, so that a weal of soft chitin is presented; the suspension of the normal processes in this case may be due to the suppression of moulting procured by the parasite, but in the former case no parasite could be detected, and the crab was perfectly normal in all other parts of its skeleton.

Figs. II. *a* & *b* are the outer and inner surfaces of a chela which presents the unusual feature of an extra index of the merus; that it is a true duplicity, and not the most rudimentary condition of a supernumerary appendage, such as Bateson (1894, p. 535) has shown may be the real status of many simple processes on Crustacean chelæ, is indicated by the fact that its concave border has the same symmetry as that of the fully developed index (although it is not toothed), and by the dactylus being displaced towards the process, so that it plays in between the two points and would actually rather suggest that the more simple is the more legitimate of the indices. Examples parallel to this have been recorded by Bateson from *Cancer pagurus*, *Xantho punctulatus*, *Lupa dicantha*, *Hyas* sp., and *Maia squinado*, but I can find no case of its occurrence in *Carcinus*; teratologies and deformities seem to be unexpectedly rare in the shore-crab in spite of the abundance and pugnacious character of this species.

* M. Przibram, Archiv. Entwickl.-Mech. xxiii. p. 896 (1907).

Both these right-hand chelæ, of which the first is from a male and the second from a female, are of the minor or Z-type ("Zwickscheren" or "cutting-chelæ"), and thus tend to support Przibram's view* that teratologies in the limbs of Arthropods are often caused by faults and disturbances in the regeneration of a lost appendage, but it should be observed that this cannot be the sole cause, since Delphy has published figures of right-hand chelæ of the major or K-type ("Knackscheren" or "crushing-chelæ") of *Carcinus mœnas* and *Portunus puber*, each bearing a supernumerary rudimentary chela on the merus.

The appended Bibliography is believed to contain all the published work on abnormal chelæ of Brachyura that has appeared since Bateson's well-known study of discontinuous variation.

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* H. Przibram, 'Experimental-Zoologie,' vol. ii. p. 121 (Leipzig) (1909).

IX. — *Otoliths of Fishes from the Upper Kimmeridgian of Buckinghamshire and Wiltshire.* By G. ALLAN FROST, F.L.S., F.G.S., F.Z.S.

[Plate V.]

THE otoliths described were obtained from the Upper Kimmeridgian (*Ammonites pallasianus* zone) of Hartwell and Aylesbury, Buckinghamshire, and at the junction of the Buckingham and Bicester Roads, near Aylesbury, also from the same zone at Swindon, Wiltshire.

I am indebted for them to Mr. T. H. Withers, F.G.S., of the Geological Section of the British Museum Nat. Hist. Department, South Kensington. These otoliths, which are all small, are as a rule sharply defined and have not been subjected to erosion.

Those now described all show strong affinities with the otoliths of the Elopidae, the outstanding feature being the uniform simplicity of form when compared with those of later fishes. They are all straight in their length, those of recent and many tertiary forms usually being curved.

In those which are pointed anteriorly the upper edge of the rostrum runs in most cases in a straight line to the dorsal rim, without notch or antirostrum. This gives a symmetrical arrowhead form to the front of the otolith not to be found in later species.

The rounded posterior rim of these pointed otoliths occurs very exceptionally in those of recent fishes, and is not common in tertiary forms, it being evidently a primitive feature.

The *sulcus acusticus*, the most important point in determining the relationship of a species, is very simple in form, being in every case straight and uncurved, and very much broader relatively to the otolith than in recent forms.

These otoliths have no resemblance to those of the existing Holosteans, *Lepidosteus* and *Amia*.

Belonging to a family of the Neopterygian group as defined by Mr. C. Tate Regan (Proc. Zool. Soc. Lond. 1923), they exhibit all the essential features shown in the otoliths of the Elopidae, but with those features broadened and simplified.

In the Upper Jurassic, to which these otoliths belong, the Elopidae were represented by the Leptolepididae, with whom they have very many points in common, and to this latter family I have no hesitation in assigning them.

Otolithus (Leptolepididarum) simplex, sp. n.
(Pl. V. fig. 1.)

Dimensions. $3 \times 1\frac{3}{4}$ mm.

Diagnosis. Shape ovate, biconvex, front pointed, dorsal rim curved, posterior rim rounded, ventral rim curved. Rostrum, no antirostrum or notch. Sulcus wide, straight, termination rounded, does not approach posterior rim.

Remarks. The rounded posterior rim, the plain symmetrical rostrum, and the straight sulcus ending some distance from the hinder edge of the otolith are most nearly approached in those of certain of the Elopidae, *Elops hawaiiensis* and *Megalops cyprinoides*.

Simpler in design and coarser in detail than in the otoliths of Tertiary and living species, the points mentioned do not occur in conjunction, except in the otoliths of this family. This earliest form yet described of a teleostean saccular pointed otolith displays, as we should expect, a primitive simplicity in its features not to be found in the otoliths of later fishes, and from a form similar to this can be traced step by step the evolution of many later forms. I therefore refer this otolith to the Leptolepididae, and have named it *Otolithus (Leptolepididarum) simplex*, sp. n.

Occurrence. Upper Kimmeridgian of Hartwell, Buckinghamshire. *Ammonites pallasianus* zone.

Age. Jurassic.

Otolithus (Leptolepididarum) plicatilis, sp. n.
(Pl. V. fig. 2.)

Dimensions. 3×2 mm.

Diagnosis. Ovate, outer side flat, inner side convex. Dorsal rim curved, falling in above the ostium, ventral rim keeled, posterior rim divided by notch into two rounded protuberances. Rostrum blunt, slight indentation in front of ostium, antirostrum slight. Sulcus straight with ridge above it, ostium wide and depressed, cauda wide, terminating some distance from posterior rim.

Remarks. The rounded posterior rim with a median notch is seen exceptionally in the case of some recent percoids, the ventral area is deeper and more keeled than in Pl. V. fig. 1, and the antero-dorsal line, which in fig. 1 is straight, is broken by the very slightly indicated antirostrum.

Occurrence. Upper Kimmeridgian of Hartwell, Buckinghamshire. *A. pallasianus* zone.

Age. Jurassic.

Otolithus (Leptolepididarum) cristatus, sp. n.
(Pl. V. fig. 3.)

Dimensions. $3\frac{1}{2} \times 2\frac{1}{4}$ mm.

Diagnosis. Broadly ovate, outer side and inner side flat with a raised crest surrounding the sulcus. Dorsal rim rounded and higher than preceding varieties, ventral rim keeled, posterior rim rounded. Rostrum blunt, antirostrum slight. Sulcus wide, slightly oblique, ending well away from posterior rim.

Remarks. This form differs from the preceding varieties described in the height of the dorsal rim, and in the crest surrounding the sulcus, which is a feature of the otoliths of the tarpon, *Megalops atlanticus*, in which the crest is greatly developed.

Occurrence. Scarce. Upper Kimmeridgian of Hartwell, Buckinghamshire. *A. pallasianus* zone.

Age. Jurassic.

Otolithus (Leptolepididarum) cuneiformis, sp. n.
(Pl. V. fig. 4.)

Dimensions. 4×2 mm.

Diagnosis. Shape cuneiform, outer side furrowed, inner side convex. Dorsal rim curved or straight, sloping forwardly, ventral rim curved with deeply cut furrows forming serrations of the edge, posterior rim upright with rounded ends.

Ventral area with longitudinal straight ridge from point of rostrum to posterior rim, with flat sides sloping dorsally to the sulcus and below to the ventral rim. Frontal rim with extended rostrum, no antirostrum or notch. A straight edge extends from point of rostrum to dorsal rim. Sulcus straight, ostium opens widely on frontal rim, cauda deep, slight curve at termination which closely approaches posterior rim.

Remarks. Without any ornamentation, except the serrations and furrows of the ventral rim, this otolith is simple and primitive in form. The ventral area with its ridge is quite unique, and this form does not appear in recent otoliths.

With this exception, the otolith, especially with regard to the sulcus, resembles those of the Elopidae.

Occurrence. Upper Kimmeridgian of Hartwell, Buckinghamshire. *A. pallasianus* zone.

Age. Jurassic.

Otolithus (Leptolepididarum) elongatus, sp. n.
(Pl. V. fig. 5.)

Dimensions. $5 \times 2\frac{1}{2}$ mm.

Diagnosis. Long ovate, outer side flat, inner side convex. Dorsal rim curved, falling away side forwardly, ventral curved, posterior rounded. Prominent rostrum, no antirostrum or notch. Frontal rim straight from point of rostrum to where it joins the dorsal rim. Sulcus straight, ostium opens widely on frontal rim, cauda constricted, deep, lower line straight, upper line curves down at termination, does not reach posterior rim.

Remarks. While the general form and the shape of the ostium are Elopine, the cauda is very percoid in appearance, showing a great advance on the previous species described.

With the exception of the rounded plain posterior rim, this might be the otolith of a tertiary or recent species. Unfortunately, the otolith from which the drawing was made has been destroyed, but a photograph was secured before this happened. A smaller example and part of another are all that remains of this species.

Occurrence. Upper Kimmeridgian of Hartwell, Buckinghamshire. *A. pallasianus* zone.

Age. Jurassic.

Otolithus (Leptolepididarum) pentangulatus, sp. n.
(Pl. V. fig. 6.)

Dimensions. $4\frac{1}{2} \times 3$ mm.

Diagnosis. Dorsal rim flat and shortened in front. Ventral rim symmetrically produced downward to median rounded angle. Posterior rim at right angle to dorsal. Frontal rim rounded. Sulcus very wide, straight. Ostium small, cauda reaches posterior rim.

Remarks. This species resembles in a remarkable degree the otoliths of the deep-sea salmonoid, *Argentina sphyraena*, which exhibits strong Elopine features. The dorsal area and rim, the squareness of the posterior rim, and the width of the cauda are similar to the otoliths of *Beryx*. The cauda differs in being straight, and resembles in this respect the species described by Koken, from the Oligocene, as *Otolithus (Berycidarum) geron*. It is not suggested that this is a Berycoid otolith, but it shows a tendency to features characteristic in later times of the Berycidae. The deep median angle of the ventral rim occurs in the otoliths of *Holocentrum rubrum* and in *Argentina*, but, as this also

occurs in *Dentex*, this point can be disregarded. The sulcus, consisting of a small ostium and wide straight cauda, is Elopine in character, with the exception of its width.

Occurrence. Numerous. Upper Kimmeridgian of Aylesbury and Hartwell, Bucks, and Swindon, Wilts. *A. pullasianus* zone.

Age. Jurassic.

EXPLANATION OF PLATE V.

Jurassic Otoliths.

- Fig. 1.* *Otolithus (Leptolepididarum) simplex*, sp. n. $\times 8$.
Fig. 2. — (—) *plicatilis*, sp. n. $\times 9$.
Fig. 3. — (—) *cristatus*, sp. n. $\times 9$.
Fig. 4. — (—) *cuneiformis*, sp. n. $\times 10$.
Fig. 5. — (—) *elongatus*, sp. n. $\times 8$.
Fig. 6. — (—) *pentangulatus*, sp. n. $\times 11$.

X.—The Geographical Races of *Oryzomys ratticeps*.

By OLDFIELD THOMAS.

THE fine Coludo *Oryzomys ratticeps*, Hensel, ranges from São Paulo in the north to Rio Grande do Sul in the south, and westwards to Paraguay. A good series of it sent by Sr. E. Budin from Misiones has enabled me to compare its representatives at the three extremes of its range, and I find that they may be readily separated into three races, as follows:—

Oryzomys ratticeps ratticeps, Hens.

Size smaller. General colour greyish brown, not markedly buffy as in the other forms.

Skull about 39 mm. in greatest and 36–38 mm. in condylo-incisive length.

Hab. Rio Grande do Sul (*Hensel, Ihering*), Misiones (*Budin*), Santa Catharina (*Ehrhardt*).

Twelve specimens examined.

Oryzomys ratticeps tropicius, subsp. n.

Size about as in true *ratticeps*. General colour buffy brown, the sides stronger buffy. Under surface also more definitely buffy.

Dimensions of type:—

Head and body 165 mm.; tail 205; hind foot 35; ear 23.

Skull: greatest length 39.5; condylo-incisive length 36; upper molar series 6.

Hab. São Paulo and Parana Provinces. Type from Piquete, São Paulo. Alt. 700 m.

Type. Adult male. B.M. no. 1.6.6.34. Original number 550. Collected 26th January, 1901, by A. Robert. Presented by Oldfield Thomas. Four adult specimens.

Oryzomys ratticeps paraganus, subsp. n.

Size decidedly larger than in the other subspecies, as gauged by the skull. Colour even richer and brighter than in *tropicus*, buffy brown, the sides clear buff. Under surface buffy whitish.

Skull generally about 42 mm. in greatest and 39 mm. in condylo-incisive length. Other characters as usual.

Dimensions of the type:—

Head and body 197 mm.; tail 216; hind foot 39; ear 25.

Skull: greatest length 42.2; condylo-incisive length 38.8; upper molars 6.4.

Hab. Paraguay. Type-series from Sapucay.

Type. Adult female. B.M. no. 4.1.5.24. Original number 1084. Collected 28th August, 1903, by W. Foster. Fifteen specimens.

This fine Paraguayan representative of *O. ratticeps* is readily recognizable by its greater size and brighter colour. Had it not been that one old specimen of subspecies *tropicus* has a skull as long as that of *paraganus*, one might have been tempted to consider the latter as a distinct species.

XI.—Notes on the Genus *Agrias* [*Lepidoptera*].

By PERCY I. LATHY, F.E.S.

SINCE the publication of the first part of 'Thèses Entomologiques' in 1921, Madame Gaston Fournier has considerably added to her collection of this genus, and thanks to the untiring energy of that wonderful collector, the late A. H. Fassl, a number of striking new forms have been received from the Amazon district.

When Fassl passed through Paris on his way to the Amazons, he told me that he was going to find all the rare species that had been taken years ago by Bates, Wallace,

Hahnel, and Michaelis. Before he died he not only rediscovered all these classical species, *Papilio hahneli*, *Papilio quadratus*, *Agrias hewitsonius*, *Agrias pericles*, *Agrias olivencia*, &c., &c., but he found among the *Agrias* many forms that we had never even dreamt of: forms of *Agrias narcissus* that resemble on the upperside *sardanapalus* and *claudia*; forms that we hardly know where to place, such as *excelsior* and *jordani* described in this paper; the unknown females of *sardanapalus* and *olivencia*, and a host of other interesting forms.

By the death of Fassl we have lost the most skilful collector of Lepidoptera that the world has ever known, and his loss is to be most deeply regretted by all who are interested in the study of Lepidoptera.

In this present paper my object is to describe certain striking forms of *Agrias*, all of which are to be figured in later parts of 'Thèses Entomologiques,' and at the same time to call attention to certain interesting facts that have struck me during my re-arrangement of this group in Madame Fournier's collection. Authors have nearly always disagreed as to the number of species the genus *Agrias* really contains, and personally I am of opinion that this question will never be satisfactorily settled until a thorough study has been made of the early stages; of course, a careful study of the genital organs would probably be of a considerable help, but here I am of the opinion that this would have to be done on a very large scale, as it is possible that with insects so exceedingly variable as the *Agrias*, variation may exist also in these organs.

At present we can count upon there being almost certainly four species, *aedon*, *amydon*, *claudia*, and *narcissus*, with probably two more in *hewitsonius* and *phalcidon*.

Aedon appears to be the only species that is not variable. This species is confined to Colombia, and so far all the specimens that I have seen are very constant.

Amydon is exceedingly variable, and whether the numerous forms that are found in the Amazon valley are all races of this species or whether *phalcidon* is really distinct yet remains to be proved; certainly the occurrence of such widely different forms as *tryphon*, Fruhstorfer, and *excelsior*, Lathy, in the same locality tends to prove that *phalcidon* is distinct.

Claudia is another very variable species, and the discovery of the new forms of *narcissus* on the south bank of the Amazon makes one wonder if perhaps one day a place will not be found where the two species intermingle. As, however, at present there are no forms known where

there is any form of passage between the distinctive undersides of the two species, I think we may keep them apart.

As to *hewitsonius*, before we can really decide upon this being a species we want much more material from São Paulo de Olivença. As will be seen in the description later on, in this locality are what may either be two species closely resembling each other, or, on the other hand, when a long series has been obtained we may find them to be the connecting-link between *phalcidon* and *hewitsonius*.

When I described and figured a large number of aberrations of *A. claudia* from French Guiana ('Thèses Entomologiques,' i. pp. 12-17, pl. i.-vi., 1921), I had no material whatever from the north bank of the Amazon; since then Madame Fournier has received a certain number of specimens from Manaos, and I am obliged to modify certain views that I then expressed.

First of all, I wish to correct the error that I made in connection with *cræsus*, Riffarth, not Staudinger. Riffarth described the race from a female from Para, and Staudinger afterwards described a male from Itaituba as being the male of the Para female. This Itaituba form has now been renamed by Fassl *michaeli*; it is, of course, quite different from the Guiana form that I figured as *cræsus*, as it has the bow-shaped black bar on the costa of the hind wing below, and not the double black bar as in the form from the north bank of the Amazon: I therefore propose the name of *regalis* for this aberration. I have also noticed that there appears to be a constant difference between *claudia* from the banks of the Amazon and those from French Guiana, inasmuch as the Amazonian specimens are usually more purplish red and the subapical pale band of the primaries below is always wider; I consider therefore that the name of *amazonica*, Stdgr., should be applied to this race.

In the region of Manaos *claudia* is even more variable than in French Guiana. The series figured in 'Thèses Entomologiques' was carefully selected from many hundred specimens; from Manaos I have but 24 examples before me, and they exhibit the following variation on the upper surface.

Four males, one of which could be regarded as typical *claudia*, one as typical *rahlkei*, with exception of a violet reflection on the black mark of inner margin of fore wing, one is intermediate between the two and has the red patch on the hind wing considerably reduced, and one which corresponds to ab. *imperialis*, Lathy. Of the females one is *claudia*, two approach nearly *sahlkei*, three have but traces of

red in the cell of hind wing, and two are entirely without; one has an obscure violet patch beyond the red area of fore wing and very slight traces of red about cell of hind wing, and again another has also subapical violet patch on fore wing and a discal violet patch on hind wing, the nervules within this patch being red; this last form agrees fairly well with the male that I described under the name of *imperialis*. The remaining specimens, three males and seven females, belong to a most beautiful form, which I describe below.

Agrias amazonica, ab. *le cerfi*, ab. nov.

♂.—Upperside: Fore wing with red band the shape of *claudia* ab. *sahlkei*, but of the colour of typical *claudia sardanapalus*; beyond this red area is a large brilliant blue patch as in the most brilliant *sardanapalus* from Teffé; the triangular patch on inner margin of fore wing is also of this brilliant blue; a large discal brilliant blue patch on hind wing. Underside as in *amazonica*, but subapical band of fore wings whitish.

♀.—Similar to ♂, but larger and wings more rounded, the red area of fore wing not purplish red but orange-red; fore wing with subapical white spots.

Manaos, Amazonas.

These ten specimens show a considerable amount of variation: two males have the blue less brilliant than in the specimen described, and one approaches the *claudia* form in the shape of red area of fore wing; two of the females have distinct subapical white spots on the fore wing above; in the shape of the red area of the fore wing they all agree with the *sahlkei* form; the blue patch on the hind wing varies considerably in size and intensity of colour.

We have not yet sufficient material to say which is the prevalent form of *amazonica*; in French Guiana the form with large red patch on hind wing is undoubtedly predominant, the aberration without red on the secondaries being very much rarer; *sahlkei* and *claudia* appear to be equally divided, and all forms of passage occur between them in both sexes, but I have remarked that in Guiana specimens when the hind wing has no red the fore wing always belongs to the *claudia* form.

According to material known up to the present, *claudia* appears to be limited to the north bank of the Amazon as far as the Rio Negro; from Tonantins, which is on the

north bank of the Amazon but on the south side of the Rio Negro, we get typical *sardanapalus*. It is quite easy to distinguish *sardanapalus* from *claudia*, the former having a bow-shaped black mark on the costa of the hind wing below, this bow-like mark begins at præcostal nervule and extends along costa and joins the first discal black line; in *claudia* this mark is replaced by two black bars which are separated by greenish grey. On the south bank of the Lower Amazon we have *sardanapalus* races with red patch on the hind wing as in *claudia*; on the north bank of the Upper Amazon the blue hind wing is predominant, and I have seen but one male from Manicore, Rio Madeira, that has a red patch on hind wing. Fassl discovered the hitherto-unknown female of this race, and it turns out to be exceedingly variable.

The predominant form is that which has the hind wing entirely black; some specimens have slight traces of blue and others traces of red scaling along the nervules. The red area of fore wing is more orange-red than in the male, and as usual the specimens are much larger and the wings more rounded.

One female has a large discal violet-blue patch on hind wing, thus resembling *claudia* ab. *vesta*, Fruhs.; another has the hind wing entirely black, but with violet-blue beyond red area of fore wing; four others have traces of violet-blue both on fore and hind wings, while two have very distinct violet-blue patches at apex of fore wing and on disc of hind wing, thus having the appearance of *claudia* ab. *fassli*.

Agrias sardanapalus, ab. *sanguinea*, ab. nov.

♂.—Upperside: Fore wing with very extended red area as in typical *sardanapalus*; hind wing with very large discal red patch, inwardly edged with violet. Underside as in typical form.

♀.—As in typical form, but hind wing with discal red patch.

1 ♂, Manicore, R. Madeira; 1 ♀, Teffé.

Until Fassl discovered the wonderful new forms of *narcissus*, Stdgr., on the south bank of the Amazon, this species was regarded as very constant for an *Agrias*, but now we can expect as much variation in it as in the *claudia* forms. The yellow-banded female from Manaus was perhaps not so very extraordinary, but the wonderful *illustrissimus* from the Rio Xingu was certainly one of the most interesting captures made by this indefatigable collector.

Agrias narcissus obidonus, subsp. n.

This race is somewhat smaller than the typical *narcissus* from French Guiana. The underside is not of such a greenish tinge, and the band of the fore wing below is orange in the male as well as in the female. On the hind wing the light-centred black spots of postdiscal row are smaller. On the fore wing below, the black patch between lower and middle submedian nervules is partly replaced by orange.

1 ♂, 2 ♀ ♀, Obidos, Amazons.

Agrias amydon, Hew.

I have before me a long series of the Colombian race, 68 males and 6 females; in this series are to be found all the transitions between the form described by Fruhstorfer under the name of *mucoensis* and the typical *amydon*, Hew. I would point out that the figure in Seitz that is supposed to represent *amydon* is really *mucoensis*; the form with the entirely black hind wing described by Fassl as *larseni* is also connected by forms of passage to specimens which have large blue spots. Among the series are two aberrations worthy of notice.

Agrias amydon, ab. *flavifasciata*, ab. nov.

♂.—This aberration resembles typical *amydon*, Hew., with the exception of the red band of the fore wing above and below being replaced by a deep orange-yellow.

2 ♂ ♂, Colombia.

Agrias amydon, ab. ♀, *bellatrix*, ab. nov.

♀.—Differs from typical female in the hind wings above having a postcellular large blue patch as in the most conspicuous of the males; forms of transition exist between this striking variety and the type.

Under the name of *eleonora*, Fruhs., was described a female from Ecuador, and afterwards in Seitz he places as the male of this female a specimen from Bolivia!! Judging from the figures in Seitz these are quite different from each other. In the Fournier collection there are only two specimens of the *amydon* group from Ecuador, and these two are very different from each other, one agreeing very well with *amydonius*, Stdgr., while the other

agrees quite well with *tryphon*, Fruhs., with the exception of the subapical pale spots of fore wing above being barely indicated and the band of the fore wing below being orange instead of red.

The Peruvian subspecies was first described and figured by Niepelt in 'Lepidoptera Niepeltiana,' p. 31, pl. iii. f. 5, 1913. Fruhstorfer in Seitz, p. 574, 1916, describes the race from Peru under the name of *ozora* and gives the name of *athenais* to a form which has a larger blue spot on the hind wing; it is this latter form that agrees with typical *aristozenus*, and I think both names should sink as there are undoubtedly all forms of transition between the two, and also there is no doubt that a form exists in which the hind wing is entirely black as in *larseni*, Fassl.

Agrias amydon aristozenus, ab. *citrinarius*, ab. nov.

This is similar to the typical form, but the band of the fore wing above and below is yellow as in *amydon boliviensis*; the blue spot on the hind wing above is small.

1 ♂, Juanjus, Peru.

Under the name of *tryphon*, Fruhstorfer has united two forms in the collection Staudinger, one from Ucayali and the other from São Paulo de Olivença; this latter has a large blue patch on the hind wing above, and the former has the hind wing black.

As Fruhstorfer mentions the form with the black hind wing first, Seitz, p. 573, it is to this that his name of *tryphon* must be applied, and as up to the present the form from São Paulo de Olivença and Tonantins shows always a very great development of the blue spot of the hind wing, I propose the name of *extensa*, and at the same time I describe the hitherto-unknown female which exists in two forms.

♀.—Similar to ♂, but larger and wings more rounded. Postdiscal blue patch of hind wing above very much larger than that of the male, nearly three times the size.

1 ♀, S. Paulo de Olivença.

Agrias pericles tryphon, ab. ♀, *flava*, ab. nov.

Similar to the preceding, but the band of the fore wing yellow above and below; a brownish-yellow patch at base of hind wing above filling cell.

1 ♀, Tonantins.

Fassl has described under the name of *pericles biedermanni* a form from Obidos. This appears to me to be nothing more than the race previously described by Fruhstorfer under the name of *trajanus*. Fruhstorfer describes his *trajanus* as having a reddish-yellow basal area on the fore wing above, and I can find no differences in the description of Fassl by which I can distinguish *biedermanni* from *trajanus*. Madame Fournier has a good series of this form from Obidos and Manaos, in all sixteen males and ten females. These show a fair amount of variation; and two males and three females from Manaos are orange as in the Guiana form. With the exception of one male these all have the submarginal greyish streaks on hind wing above. I do not name this yellow variety, as the material from Guiana is so scanty. I know of but one male from this locality, an orange one; it is, of course, possible that the Guiana ♂ is always yellow, and that this form turns up occasionally as an aberration on the bank of the Amazons. Fassl states that he had received a male of *aurantiaca* from the Rio Trombetas; his description of this does not agree with the male from F. Guiana in Madame Fournier's collection, as he states that it is of the same colour as the female, whereas the Guiana male is orange. Of the reddish form with submarginal greyish streaks on the hind wing above there are two males and two females from Obidos and one female from Manaos; one very remarkable male from Manaos has the right hind wing below entirely black from base to post-discal row of bluish spots, with exception of a pale greenish line beginning near inner edge of upper pale spot and continuing to the lower, where it turns up and finishes at lower edge of cell.

Agrias pericles trajanus, ab. *immaculata*, ab. nov.

This aberration differs in both sexes from the type in entirely wanting the submarginal grey streaks on the hind wing above.

Manaos (types), Obidos.

Agrias pericles trajanus, ab. *viridipicta*, ab. nov.

♀.—Differs from the yellow form of the female in having the inner edge of the subapical creamy spots of the fore wing above narrowly edged with green.

1 ♀, Manaos.

Specimens sent by Fassl from Itaituba under the name

of *pericles* have very much less green than in the specimen figured by Hewitson. Most authors give Teffé as being the locality of the specimen figured by Hewitson, but Bates ('Journal of Entomology,' vol. ii. p. 338) states that he took but one specimen, and the locality he gives is Villa Nova. One female from Itaituba should, I think, be regarded as *pericles* female, and the yellow female as *xanthippus*; this particular female has the basal area of the fore wing deep orange-red, and between this area and the subapical pale spots is a wide band of green scaling, the base of hind wing is dull brick-red.

Agrias pericles, ab. *inornatrix*, ab. nov.

♂.—Differs from both *pericles* and *xanthippus* in having no traces whatever of blue or green on both wings above. Basal area of fore wing above yellow as in *aurantiaca*, Fruhs.; of the three subapical pale spots of fore wing above, only the centre one is clearly defined.

1 ♂, Itaituba.

Agrias pericles peruviana, subsp. n.

Differs from the other forms of *pericles* in the yellow area of fore wing above being further extended along the inner margin; a brownish-yellow patch at base of hind wing above; a little greenish-blue scaling near anal angle of hind wing above. Ground-colour of hind wing below more yellow than in other *pericles* forms.

1 ♂, Inambare, Peru.

Fassl sent a long series of *Agrias phalcidon*, Hew., and I have before me 28 ♂♂ and 20 ♀♀ of this fine species. In both sexes it shows considerable variation as to extent of blue and width of green bands. Fassl regards *pericles* and *phalcidon* as distinct species; it is certain that at present no actual forms of passage between the two have been discovered, but knowing the remarkable variation of this genus it does not seem very difficult to imagine that such forms exist: there is already a commencement by the races *anguensis* and *rubrobasalis*, both of which have the basal markings below red instead of yellow, and in the aberration *anaxagoras*, Stdgr., we have a yellow base above and below; in finding a corresponding aberration in red we shall have already a commencement of *pericles*. Then there is also the aberration of the female described by Fassl under the name of *mirabilis*, in which the basal yellow spot

of *anaxagoras* is produced in a fascia towards anal angle; here again we have only to find a corresponding aberration with a red fascia—by no means unlikely, as red and yellow forms of *Agrias* are frequently found—and we are still nearer to *pericles*.

Agrias phalcidon, ab. *connectens*, ab. nov.

This aberration is the form of passage between typical *phalcidon* and the aberration *anaxagoras*. The male has the green bands of the wings above very narrow as in *anaxagoras*, but the basal orange patch is entirely wanting; the fore wing below differs from that of *phalcidon* in having the cell entirely filled with orange: the female differs in a similar manner, with the exception that the green bands above are wider than those of *anaxagoras*.

Itaituba.

Agrias phalcidon, ♀, ab. *similis*, ab. nov.

I give this name to the form of the female which resembles the most brilliantly coloured males, and has a large violet patch at base of fore wing and green band of fore wing widely bordered internally with violet; the hind wing also has a small violet patch in and below cell, and the green band bordered internally with the same colour. This aberration also occurs in the race *xinguensis*, and probably everywhere where *phalcidon* is found.

Itaituba.

Agrias phalcidon, ab. *micans*, ab. nov.

I give this name to a very striking underside aberration which has the inner part of the black area surrounding the row of postdiscal pale spots densely powdered with metallic-green scales, thus giving this band a most striking effect. Up to the present I have only seen this aberration in the female.

Itaituba.

Agrias phalcidon excelsior, subsp. n.

♂.—Upperside: Fore wing with curved orange fascia from base to near anal angle, space below deep violet-blue, a patch of similar colour on outer border of the orange fascia; faint indication of subapical greyish spots; apex and outer margin black. Hind wing black with large

violet-blue patch occupying space between cell to nearly outer margin; faint indications of green scaling on outer edge of this patch near anal angle; tufts yellowish brown.

Underside: Fore wing with fascia as above, but paler; apical markings as in *phalcidon*. Hind wing with pattern as in *phalcidon*, but the band that encloses the postdiscal row of pale-centred black spots orange gradually fading off to greenish yellow towards anal angle.

♀.—Similar to male, but larger and wings more rounded; violet patch towards apex of fore wing above more obscure; subapical whitish spots more distinct. Hind wing with violet patch more extended towards base and inner margin, greenish scaling on outer edge more defined. Underside differs in outer band being more of a greenish orange.

3 ♂♂, 2 ♀♀, Tonantins.

Agrias phalcidon excelsior, ab. *flavibasis*, ab. nov.

Differs from the typical form in having the ground-colour of the basal third of hind wing pale yellow instead of greenish, and the basal black bands deep orange instead of black.

The female is slightly aberrant in having a splash of deep violet in the yellow fascia of the right fore wing in and beyond cell.

2 ♂♂, 1 ♀, Tonantins.

This magnificent race resembles very much in appearance *Catagramma excelsior*, of which a series was sent from the same locality.

From S. Paulo de Olivença we have the gorgeous *Agrias* described by Staudinger under the name of *olivencia*. I have before me eight specimens, four males and four females, and I think that in this spot we have two species, one belonging to the *hewitsonius* group and the other to the *phalcidon* group; or should this hypothesis be incorrect, it is here where we shall find the forms of passage between *phalcidon* and *hewitsonius*, thus proving them to be one species. I myself take the form described by Staudinger to be the extreme form of *phalcidon*, and the new form here described to be a race of *hewitsonius*.

Agrias phalcidon olivencia, Stgr.

♀.—Upperside: Fore wing black, a large basal violet spot; a submarginal curved band composed of bright green scaling; four distinct subapical grey-green spots. Hind wing black,

with a violet streak at end of and below cell; submarginal greenish band as in fore wing, this band inwardly edged with violet.

Underside similar to male, but basal orange area lighter in colour.

I have before me a series of 18 ♂♂, 11 ♀♀ of the beautiful *hewitsonius*, Bates, all from Teffé; and, judging from this series, I think we have here a species different from *phalcidon*, and that this is the name which should be applied to the species, including the various races that extend southwards to Central Peru, where we find it under the name of *beata*, Stdgr.

Hewitsonius differs from *phalcidon* in having the subapical creamy spots of fore wing above replaced by greyish-green spots; the apex of the fore wing below is greenish grey and wants the distinct creamy band of *phalcidon*; the postdiscal row of pale-centred black spots are well separated from each other by the greenish ground-colour; the apex of costa of hind wing is not whitish as in the *phalcidon* and *amydon* forms.

The species is very variable, some specimens having a green border on the outer edge of violet patch of fore wing above as conspicuous as in *phalcidon*, ab. *anaxagoras*, and in others this is wanting entirely as in *phalcidon* *fournieræ*; the extent of violet patch of hind wing above is as variable as in *claudia lugens*; some specimens have discal veins of hind wing above orange; the basal orange area of both wings above and below varies considerably in extent.

Agrias hewitsonius jordani, subsp. n.

♂.—Upperside: Fore wing deep violet-blue, with slight indications of a black band as in *stuarti*; towards apex the blue ground-colour is edged with a narrow band of green; faint indications of subapical greyish-green spots; apex black. Hind wing black, a narrow violet-blue patch at lower end of and below cell; a submarginal violet-blue band along lower half of wing, this band edged outwardly with green.

Underside: Fore wing as in *olivencia*, but with apex entirely greenish as in *stuarti*, and showing no trace whatever of a subapical pale band which is more or less well defined in *olivencia*. Hind wing differs from *olivencia* in having the inner row of black spots well separated from each other; postdiscal row of light-centred black spots much smaller,

and consequently widely separated from each other by the grey-green ground instead of being confluent as in *olivencia*.

♀.—Upperside: Fore wing differs from *olivencia* in having a wide grey-green band beyond the submarginal green band; this grey-green band continued to anal angle. Hind wing has submarginal green band not so pronounced and no violet-blue in cell; a marginal border of grey-green. Underside differs from *olivencia* in the same manner as in the male.

1 ♂, 2 ♀ ♀, São Paulo de Olivença.

Agrias hewitsonius rothschildi, subsp. n.

♂.—Upperside: Fore wing with marginal greenish-grey borders narrower than in *beatifica*, the blue area traversed by a black band as in *stuarti*. Hind wing with greyish-green border much narrower than in *beatifica*, and traversed by a dark brown line.

Underside: Fore wing as in *beatifica*, but basal red area reduced to a small costal patch. Hind wing as in *beatifica*, but basal red area very much reduced between costal and lower submedian nervule.

1 ♂, Yurimaguas.

This appears to be the race between *beata* from Central Peru and *beatifica* from Ecuador. I believe there are other specimens in the collection of Mr. Joicey.

Agrias hewitsonius beata, Stgr.

♀.—Similar to male, but much larger and with more rounded wings. Fore wing with small basal violet patch. Hind wing black, marginal grey border somewhat wider than that of the male and not intersected by a dark line. Underside as in male.

1 ♀, Chanchamayo, Peru.

XII.—*Von Schlechtendal's Work on Fossil Thysanoptera in the Light of Recent Knowledge.* By RICHARD S. BAGNALL.

WHEN Dr. D. von Schlechtendal published his "Physopoden aus dem Braunkohlengebirge von Rott am Siebengebirge" in 'Zeitschrift für Naturwissenschaften,' Bd. lx. pp. 551-592, pls. iii.-v. (1887, Halle), the order Thysanoptera was but little known, whilst the author was not a student of the

recent species. To-day considerable advances have been made in the study, and one is forced to recognize the taxonomic value of certain features such as the antenna (and antennal sensoria) and chaetotaxy.

In the study of a large series of fossil Thysanoptera preserved in amber, new light is shown by the presence of several species superficially Thripid but possessing a 9-jointed antenna, wherein the last two, three, or four joints may be closely jointed, and for which I have erected the family Hemithripidae, having its closest relationship with another family of fossil species (Stenurothripidae, m.) and the Heterothripidae, a family of recent Nearctic and Neotropical species.

These three families may be regarded as representing the Heterothripodea and coming between the Æolothripodea and the Thripodea. Although there are examples in the amber-inclusa of such well-known recent Thripid genera as *Physothrips*, *Selenothrips*, and *Heliothrips* (which I have recently described), there would appear to be a greater proportion of Tertiary species referable to the Heterothripodea than to either the Æolothripodea or the Thripodea proper. I have had, however, to bring into the Hemithripidae a recent species described from South Africa in 1915 (*Homothrips distinctus*, Bagn.), to which genus one of the amber-species is also referable. The fact that the South-African species was taken by Prof. Poulton from a primitive plant belonging to the Proteaceæ is of additional significance.

Von Schlechtendal's memoir is, unfortunately, difficult to procure, and I have secured a typescript copy with photographs of the three plates made from a copy of the 'Zeitschrift' kindly loaned me by the Royal Society of London. At a future date I hope to republish these plates in connection with my work on Tertiary Thysanoptera, and in this paper I merely attempt to interpret the affinities of the species described by von Schlechtendal in the light of to-day's knowledge—a task that is rendered possible by von Schlechtendal's careful work and excellent illustrations. I hope, however, to ultimately have the satisfaction of examining von Schlechtendal's original material, but up to the present my enquiries to the Directors of the Königlischen mineralogischen Institut zu Halle have been fruitless.

It is by the presumable possession of a type of antenna such as that above described, where it is sufficiently well observable and illustrated, that enables one to refer so many of these species to the Hemithripidae. I have had to refer some species to the genus *Hemithrips* with a certain amount

of doubt, and such cases are indicated by a note of interrogation before the generic name; but of these, though it is impossible to interpret the antenna, all the species excepting *longulus* have both veins of the fore-wing regularly set with setæ.

Of the twelve species described by von Schlechtendal, the first—*Phlæothrips pohligi*—is interesting as representing the only described fossil example of the Tubulifera, though fully half a dozen species are amongst the amber-*inclusa* now in my possession. Seven are described as belonging to the genus *Thrips* and four to the genus *Heliothrips*. Of these latter, however, *H. cucullata* and *H. longipes* belong to the *Ædlothripidæ*; Uzel refers them to the genera *Lithadothrips* and *Palæothrips*, but personally I believe that these genera will not stand.

Of the seven *Thrips* spp. one is apparently referable to four and another to two distinct species, making eleven species. Of these, seven are with little doubt referable to the genus *Hemithrips*, Bagnall (originally characterized for three amber-species), whilst one represents a new and apparently allied genus described herein. This leaves three to be allocated, which, with the remaining two *Heliothrips* sp., I prefer to associate with *Hemithrips* for reasons already stated.

Schlechtendal's species 1 (*Phlæothrips pohligi*) and 9 and 10 (*Ædlothrips* (s. l.) *cucullatus* and *longipes*) do not require discussion, and are not included in the following notes.

SPECIES 2.

(?) *Hemithrips excellens* (Schl.).

Thrips excellens, Schlechtendal (in part.), ♀, p. 564, fig. 2.

♀. The type would appear to be characterized by the fore-wings having both veins regularly set with setæ, the conspicuous fringe of the hind margin of the eighth abdominal tergite, and the absence of the postero-angular bristles of the pronotum.

Two examples are recorded (coll. Pohlig).

(?) *Hemithrips setosus*, sp. n.

Thrips excellens, Schlechtendal (in part.), ♂ (sic!), p. 565, fig. 3.

♀. A species agreeing in the wing-characters and the fringe of eighth tergite, and also in the length and breadth of the head and pronotum, is figured as the ♂ of *T. excellens*. It is, however, a ♀ example, and possesses bristles at the

hind angles of the pronotum which I am confident would have been detected in the other examples had they been present. The antenna of this specimen is indicated as long and very slender.

Coll. Pohlig.

Hemithrips parallelicornis, sp. n.

Thrips excellens, Schlechtendal (in part.), ♂ (*sic!*), p. 565, fig. 4.

♀. A second and robust example, though also ♀, is figured as ♂ of *T. excellens*. There are no indications of the postero-marginal fringe of tergite 8 or of pronotal bristles. The antennæ are stout, with the segments parallel-sided and closely jointed; they are undoubtedly Hemithripid in character, and I would interpret the figure of the right antenna in fig. 4 as follows:—

First joint=joint 2,
second (long)=joints 3+4+5,
and third to end=joints 6+7+8+9,

the apical half (from where a suture is suggested) representing 7-9.

Coll. Pohlig.

Hemithrips schlechtendali, sp. n.

Thrips excellens, Schlechtendahl (in part.), p. 565, figs. 5-8.

♀. This example is from another collection, and is fully figured. The veins of the fore-wing are set with setæ, but there is no indication of the postero-marginal fringe of tergite 8. The pronotum is shorter and strongly transverse, whilst a short seta is shown at each hind angle. The antennæ are shown as distinctly jointed, the intermediate joints being roughly oviform and subequal. Fig. 8 represents joints 2, 3, 4, 5, and 6 all distinct (though 3 and 4 are probably lying at an angle, and consequently foreshortened), and joint 7 narrowing to a point represents 7-9, the apical half or thereabouts representing 8 and 9.

Coll. Frech.

SPECIES 3.

(?) *Hemithrips longulus* (Schl.).

Thrips longula, Schlechtendal, p. 568, fig. 9.

SPECIES 4.

Hemithrips pennifera (Schl.).

Thrips pennifera, Schlechtendal (in part.), p. 570, figs. 10 & 11.

♀. The interpretation of the antennal joints shown in fig. 11 is as follows:—

$$\begin{aligned} 1 \text{ and } 2 &= 1 \text{ and } 2, \\ 3 &= 3 \text{ and } 4, \\ 4 &= 5 \text{ and } 6, \\ \text{and } 5 &= 7 \text{ to } 9. \end{aligned}$$

It will thus be seen that with the exception of the minute second joint (unusually large in *schlechtendali*) it approximates closely to the form of antenna in *schlechtendali*, sp. n.

Coll. Pöhlig.

Hemithrips thoracicus, sp. n.

Thrips pennifera, Schlechtendal (in part.), p. 570, fig. 12.

♀. Both this and the previous example are ♀ ♀, and in neither case is there any indication of pronotal bristles or of a postero-marginal fringe on tergite 8. This example is markedly larger than *pennifera*, being 1.5 mm. long as compared with 1.25 mm. The head is slightly more transverse, the pronotum broadens posteriorly, whilst the mesonotal plate (which is short and has the hind margin gently rounded in *pennifera*) is markedly angulate.

Coll. Frech.

SPECIES 5.

Hemithrips breviventris (Schl.).

Thrips breviventris, Schlechtendal, p. 572, figs. 13 & 14 (fig. 15 doubtfully the same species).

♀. This species is figured as having two bristles at each hind angle of pronotum and also a mid-lateral pair. The antenna is well-figured in fig. 14; the fourth joint represents 4 + 5, whilst the distal joint represents 8 and 9.

Coll. Pöhlig.

SPECIES 6.

Hemithrips minimus (Schl.).

Thrips minima, Schlechtendal, p. 574, figs. 16 & 17.

♀. A small and distinct form. The fourth (long) joint of

the antenna in fig. 17 represents 4 and 5, whilst the distal joint represents 7 to 9 closely connate.

Coll. Pohlig.

SPECIES 7.

Hemithrips pygmaeus (Schl.).

Thrips pygmæa, Schlechtendal, p. 577, figs. 18 & 19.

The antenna in fig. 19 has a long median segment, apparently representing joints 3 to 6, surmounted by a club-like segment comprising 7 to 9.

Coll. Pohlig.

SPECIES 8.

Genus *EOCEPHALOTHRIPS*, nov.

♀. Head quadrate, as long as broad and longer than the pronotum; basal antennal joint abnormally large and closely approximating at their bases.

Apparently of Hemithripid affinities; as far as the figure is concerned, the antennæ (except for the first joint) are slender and joints 2 to 7 appear to be well separated and probably subequal, 8 and 9 being connate.

Type. *Thrips capito*, Schl.

Eocephalothrips capito (Schl.).

Thrips capito, Schlechtendal, p. 579, fig. 20.

SPECIES 11.

(?) *Hemithrips clypeatus* (Schl.).

Heliothrips clypeata, Schlechtendal, p. 589, fig. 24.

This would appear to be Hemithripid in affinities, but the antenna is not closely figured. The form of pronotum and the end of the abdomen suggest generic differences which may be made clear on a study of the specimen. The veins of the fore-wing are regularly set with setæ.

SPECIES 12.

(?) *Hemithrips frechi* (Schl.).

Heliothrips frechi, Schlechtendal, p. 591, fig. 25.

This species has the antenna distinctly figured and described as having eight joints, the last two joints of the left antenna somewhat closely approximating a style with broad basal

joint. As, however, Schlechtendal figures the second joint in other species as the basal or first joint (the first being a prolonged seat in the head), it is safe to regard the antenna as 9-jointed, a view that is confirmed by the shape of the so-called "first" joint. This species also has both veins of the fore-wing regularly set with setæ.

Coll. Frech.

XIII.—*Results of the Merton College Expedition to Spitsbergen, 1923.—Diptera Nematocera.* By F. W. EDWARDS.

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In a previous report* the writer has described the Diptera Nematocera brought from Spitsbergen by the Oxford University Expedition of 1921. The material obtained by the second (1923) expedition is now before me, and adds very considerably to our knowledge of the Dipterous fauna of these islands. Although the actual extent of this collection is very much smaller, the number of species obtained (26) is very nearly as great, and it is remarkable that no fewer than 13 of these were unrepresented in the first collection. This is, no doubt, to be explained by the fact that the 1923 expedition visited different parts of the archipelago. Seven species in the collection are new records for these islands, namely:—

Phronia egregia, Dz.
Cricotopus humeralis, Zett.
Trichocladus lestralis, sp. n.
Orthocladus triyonolabis, sp. n.

Orthocladus novatus, Walker.
Camptocladus cf. *lasiops*, Mall.
Tanypus barbitarsis, Zett.

In addition to these another half-dozen species were obtained in Spitsbergen which had previously only been found in Bear Island or elsewhere.

In the previous report it was suggested that many of the species which have been recorded from Spitsbergen would eventually be found identical with North European forms. In the summer of 1923 the writer had an opportunity to put this theory to the test during a few weeks' visit to Scandinavia. A week-end was spent in camp at the head of Lake Tyin, Norway, and collections were made of such species of Nematocera as could be obtained. The lake is

* *Ann. & Mag. Nat. Hist.* (9) x. p. 193-215 (1922).

situated at above 3000 ft., practically on the snow-line, and the surrounding Jotunheim Mountains rise about 3000 ft. above the lake, the conditions of climate and vegetation being very similar to those obtaining in Spitsbergen. The dominant species were two *Protanypus* and *Diamesa pubitarsis* (Zett.), all of which were in enormous numbers, but the following Spitsbergen species were also obtained:—*Ecechia frigida*, *Tanytarsus gracilentus*, *Camptocladus eltoni*, *Trichocera lutea*.

Through the kindness of Prof. Y. Sjöstedt the writer was able to examine Holmgren's and Boheman's collections in the Stockholm Museum, and notes on these are included in the present report. All the specimens mentioned by Holmgren were found in excellent preservation, and it has been possible to establish definitely the identity of all except the *Sciarinæ*, which, owing to lack of time, were not studied. As a result of this study, the following corrections appear to be necessary to the list of Spitsbergen and Bear Island Nematocera given in the writer's previous report:—

PREVIOUS NAME.	REVISED NAME.
<i>Boletina maculata</i> , Holmgren.	<i>B. apicalis</i> (Walker).
<i>Celosia</i> ? <i>setipennis</i> , Holmgren.	<i>C. tenella</i> (Zett.).
<i>Lauterbornia</i> ? <i>coracina</i> (Zett.), Edw.	<i>Tanytarsus gracilentus</i> (Holmgren).
<i>Camptocladus byssinus</i> (Holmgren).	<i>C. aquatilis</i> , Goet.
<i>C. extremus</i> (Holmgr.), Edw.	<i>C. aquatilis</i> , Goet. (? <i>opacus</i> , Mg.).
<i>C. curvinervis</i> , Kieff.	<i>C. extremus</i> (Holmgren).
<i>Orthocladus conformis</i> (Holmgr.), Edw.	<i>O. festivus</i> (Holmgren).
<i>O. festivus</i> (Holmgr.), Edw.	<i>O. decoratus</i> (Holmgren).
<i>O. decoratus</i> (Holmgr.), Edw.	<i>O. petraeus</i> , Kieff. ?
<i>Diamesa arctica</i> (Boh.), Edw.	<i>D. walthi</i> , Mg. ?
<i>D. poultoni</i> , Edw.	<i>D. arctica</i> (Boh.).
<i>Tanypus frigidus</i> , Holmgren.	<i>Trichotanypus crassinervis</i> (Zett.).
<i>Trichocera hiemalis</i> , Holmgren.	<i>T. saltator</i> (Harris).

As a result of further study and collecting, it has now been shown that a number of species which were described from and supposed to be peculiar to Spitsbergen occur in Scandinavia or Northern Siberia, and the inference seems fairly clear that the whole Spitsbergen Dipterous fauna has been derived from the mainland. Except perhaps for the subapterous *Smittia brevipennis*, it seems very doubtful if any species will eventually be proved to be endemic to Spitsbergen.

During 1922-4 a considerable amount of additional material has been received from Iceland and the Færoe Is., through Dr. B. Samundsson and Prof. Y. Sjöstedt. Study of this material confirms the statement previously made that

the Iceland Nematoceros fauna is very different from that of Spitsbergen, only four of the 50 species being the same*. Whereas the Spitsbergen fauna is of a North European type, that of Iceland has closer affinity with that of Britain and Western Europe.

SCIARINÆ.

Sciara pallidiventris, Holmgren.

N. SPITSBERGEN: Albert Dirkses Bay, Wijde Bay, 17. viii. 23, 800 ft.; shaken from plants on flower slope; 1 ♂. Liefde Bay, 28. vii. 23, 50–100 ft.; shaken from *Sax. oppositifolia*; 1 ♂.

Sciara præcox, Mg.

? Syn.: *S. arctica*, Holmgren.

N. SPITSBERGEN: Albert Dirkses Bay, Wijde Bay, 20. viii. 23; shaken from *Cassiope*; 2 ♂, 1 ♀. Liefde Bay, 28. vii. 23; shaken from *Salix polaris*; 1 ♂. Middle of S. side of Reindeer Peninsula, 22. vii. 23, 200 ft. (*T. G. Longstaff*); on leaves of *Cerastium alpinum*; 3 ♀.

Mycetophilidæ.

Boletina apicalis (Walk.).

Syn.: *Mycetophila apicalis*, Walk.; *Boletina longicauda*, Lundst.

N. syn.: *Boletina maculata*, Holmgren.

A mount was made of one of Holmgren's males, establishing the above synonymy.

Cerlosia tenella (Zett.).

N. syn.: *Boletina setipennis*, Holmgren.

The types agree.

Phronia egregia, Dz., var. *melæna*, nov.

N. SPITSBERGEN: Liefde Bay, 28. vii. 23; 50–100 ft.; flying in sun over dry tundra; 1 ♂. There is also an undetermined ♂, without data, in Boheman's collection in the Stockholm Museum.

The specimens are structurally identical with *P. egregia*, Dz., but differ in having the legs entirely black; in the type-form the coxæ are yellow and the femora largely so.

* These four species are *Cricotopus basalis*, Staeg., *C. glacialis*, Edw., *Psectrocladius limbatellus*, Holmgren, and *Tanytus barbitarsis*, Zett.

Chironomidæ.

Chironomus lugubris, Zett.

N. SPITSBERGEN: Waigat Island, S. end Hinlopen Str., 31. vii. 23, 0-50 ft.; rests on boulders, flying when disturbed; 1 ♂. S. side, middle of Reindeer Peninsula, 22. viii. 23, 100-150 ft.; on plants by fresh-water pond; 1 ♂. Liefde Bay, 28. vii. and 23. viii. 23, near shore; 2 ♂, 5 ♀. Rocky island in mouth of Wahlenberg Bay, 10. viii. 23; on wet muddy fresh-water pond; 1 ♀. Albert Dirkses Bay, Wijde Bay, 16. viii. 23; flying over *Cassiope-tundra* near fresh-water lake; 1 ♀.

W. SPITSBERGEN: Green Harbour, 26. vii. 23; flying over damp ground near shore; 2 ♀.

The suggested synonymy with Holmgren's *C. hyperboreus* may be confirmed. Zetterstedt's type of *C. lugubris* also agrees, except that the last segment of the male antennæ seems relatively a little shorter.

Chironomus coracinus, Zett.

After examining Zetterstedt's type of this species, I can state that Kieffer's identification of it and my own previous identification are both incorrect. The type-male has unfortunately lost the tip of its abdomen; but I obtained a series of specimens obviously of the same species from Lake Tyin, and from these and the type the following characters may be noted, additional to Zetterstedt's description:—

Antennæ of male with 14 segments, the last nearly four times as long as the rest of the flagellum. Frontal lobes absent. Hypopygium with the anal point very long; only two pairs of basal appendages, the upper bare, blackened, curved at tip, the lower with long recurved hairs and two long straight hairs at the tip. Front tibiæ with rounded scale; posterior tibiæ with two short spurs; pulvilli distinct, the pads dark and nearly half as long as the claws, but with a pale fringe which reaches almost to the tips of the claws. Wings with small but distinct hairs on the apical fourth. Transverse vein distinct and blackened.

From the above description it will appear that the species belongs to the *Chironomus* rather than the *Tanytarsus* group, on account of the structure of the hypopygium; except for the presence of hairs at the tip of the wing and the shorter first segment of the front tarsi (which is just perceptibly

shorter than the tibia) it answers to Kieffer's definition of his genus *Endochironomus*.

The specimens recorded by Holmgren from Bear Island as *Ch. polaris* and from Novaia Zemlya as *Ch. coracinus* have a hypopygium apparently identical with that described above, and agree in most other respects, but have no hairs at the wing-tip. If, as would appear, this is the only distinction, the Arctic form might be regarded as merely a variety of *Ch. coracinus*, which I would propose to call *psilopterus*.

Tanytarsus (Lauterbornia) gracilentus (Holmgr.).

N. syn.: *Lauterbornia coracina*, Kieff., Edw. (nec Zett.); ? *Prochironomus koenigi*, Kieff.

N. SPITSBERGEN: Albert Dirkses Bay, Wijde Bay, 16. viii. 23; on boulders by fresh-water lake, 50 ft.; 5 ♂, 9 ♀; and flying over *Cassiope*-tundra, 1 ♀.

This species has a strong superficial resemblance to the last, and has probably been confused with it; there are, however, numerous structural differences. The presence of a ventral brush-bearing appendage of the male hypopygium and the horizontal vein *r-m* clearly place the species in the *Tanytarsus* rather than the *Chironomus* group. The first segment of the front tarsus is about one-fifth longer than the tibia.

Specimens collected by me at Lake Tyin are identical with those from Bear Island and Spitsbergen; so also are specimens received from Prof. Thienemann from Eifel, and determined by Kieffer as *L. coracina*. In none of these specimens can I detect any trace of pulvilli, mentioned by Kieffer as present in his diagnosis of the genus *Lauterbornia*; I am therefore led to conclude that Kieffer's observation was either entirely mistaken or due to a confusion with the true *C. coracinus* as described above.

Tanytarsus (Micropsectra?) mimulus, Holmgr.

N. SPITSBERGEN: Albert Dirkses Bay, Wijde Bay, 19. viii. 23; on window of hut near shore; 1 ♀.

Smittia brevipennis, Holmgr.

This appears to me to be a degenerate *Camptocladus*, probably of the *minimus* group. Eyes bare; empodium as long as the claws; mesonotum rather shining; wings whitish. The male remains unknown.

Camptocladius extremus, Holmgr.

I had wrongly identified this species. Holmgren's specimens (16 ♀ from North Cape, but no ♂) are all quite evidently the species I recorded as *C. curvinervis*, Kieff.; if the determination was correct, Holmgren's name will take precedence over Kieffer's *curvinervis* and over Becher's *incertus*, which has also proved to be the same species. Holmgren's specimens have black halteres, not yellow as in Becher's and Kieffer's material.

Camptocladius aquatilis, Goet.

I do not see sufficient reason for separating the species I wrongly determined as *C. extremus* from Goetghebuer's *C. aquatilis*. So far as can be determined from an examination of the dry specimens, the males recorded by Holmgren as *C. byssinus* are also *C. aquatilis*; *C. stercorarius* (*byssinus*) must therefore be struck off the Spitsbergen list.

The species is an abundant European form, which (together with some near allies) has been frequently but wrongly referred to as *C. aterrimus*, Mg. I consider that it might be regarded as *C. opacus*, Mg.

Camptocladius longicosta, Edw.

N. SPITSBERGEN: Liefde Bay, 50-100 ft., 28.vii.23; shaken from *Saxifraga oppositifolia*; 1 ♀.

Camptocladius cf. *lasiops*, Mall.

N. SPITSBERGEN: North Cape, N. of N.E. land, 15.viii.23; under stones on dry granite slope; 1 ♀.

The specimen certainly represents a species distinct from any others which have been reported from Spitsbergen, and agrees rather well with Malloch's description of *C. lasiops*, though as there is only a single female I do not feel certain of the determination. It differs from *C. longicosta* in the shorter antennæ, with shorter and broader sense-bristles, and also in its larger size, somewhat smoky wings, and shorter cubital fork, the lower branch of which is more conspicuously sinuous.

Camptocladius pumilio, Holmgr.

N. SPITSBERGEN: middle of S. side of Reindeer Peninsula, 50-100 ft., 22. viii. 23; on stones and wet moss by stream;

4 ♂, 2 ♀. N. Bismarck Strait, 0-50 ft., 3. viii. 23; in grass on Skua hummock; 1 ♀.

This may be merely a variety of *C. minimus*, Mg. (*punctulatus*, Goet.), but the posterior part of the scutum is rather more hairy and there are very slight distinctions in the male hypopygium. In the specimens before me there are no scales on the scutum; in Holmgren's types this could not be ascertained owing to the pinning, but they appear to be the same species.

Psectrocladius borealis, Kieff.

N. SPITSBERGEN: Liefde Bay, 28. vii. 23, 50-100 ft.; flying in sun over dry tundra; 2 ♂, 1 ♀.

Psectrocladius limbatellus (Holmgr.).

N. SPITSBERGEN: Albert Dirkses Bay, Wijde Bay, 16. viii. 23, 60-70 ft.; flying over *Cassiope*-tundra near fresh-water lake, 1 ♂, 1 ♀; on window of hut near shore, 3 ♂, 3 ♀; and on rocks by lake, 1 ♀.

Holmgren described his *C. limbatellus* from three specimens; of these the two males appear to be identical with his *C. decoratus*; the female may therefore be taken as the type, and it agrees with my determination.

Orthocladius consobrinus (Holmgr.).

N. SPITSBERGEN: between Red Bay and Liefde Bay, 23. viii. 23; by lake in mountains (*J. D. Brown*); 4 ♂, 3 ♀. Liefde Bay, 23. viii. 23; on surface of fresh-water lagoon near shore; 2 ♀.

Holmgren's specimens conform to my previous determination and also to that of Lundström, who has recorded the species from the island of New Siberia.

Orthocladius conformis (Holmgr.).

N.E. SPITSBERGEN: Waigat Island, 31. vii. 23, 0-50 ft.; rests on boulders, flying when disturbed; 4 ♂, 3 ♀. Rocky island in mouth of Wahlenberg Bay, 10. viii. 23; 2 ♂, flying.

My previous determination of this species proves to have been incorrect. The above specimens, which agree with Holmgren's types, exhibit the following characters:—

Antennæ of ♂ with the last segment about three times as long as the remainder of the flagellum. Antennæ of ♀ with

six segments, segment 2 constricted in middle, 3-5 nearly round; 6 almost as long as 2-5 together, its apical half with numerous short, slender, curved sense-bristles. Empodium barely distinguishable (♂) or about half as long as the claws (♀). Wings slightly greyish, but without microscopic setæ; costa extending slightly but distinctly beyond the tip of R_5 .

Orthocladus obscuripennis (Holmgr.).

The type ♀ rather closely resembles the last, and may be a variety of it, but the costa does not extend beyond the tip of R_5 and, as stated by Holmgren, the wing appears rather broader and darker.

Orthocladus festivus (Holmgr.).

The species I wrongly described and figured as *O. coniformis* must be regarded as *O. festivus*; I have compared a mount of the hypopygium of one of Holmgren's males from Green Harbour, which formed the major part of his series and should be taken as the types. His collection also contains a male from King's Bay, which is conspecific, and a male from Bear Island; this last is different and may be *O. mixtus*.

Orthocladus decoratus (Holmgr.).

N. SPITSBERGEN: middle of S. side of Reindeer Peninsula, 22. viii. 23, 50-100 ft.; on stones and wet moss by stream; 8 ♂, 1 ♀.

Comparison of mounts of the hypopygium of one of Holmgren's males and of one of the above specimens shows that this is the species I recorded and figured as *O. festivus*. The female mentioned by Holmgren from Kobbe Bay belongs to a different species, and is probably *O. petræus*, Kieff., as is the female I recorded as *O. decoratus* from Kobbe Bay. In *O. petræus* (♂ ♀) the wings are finely punctate and the empodium is well developed, while in *O. decoratus* (♂ ♀) the wings are quite bare and slightly milky and the empodium is only just distinguishable.

Orthocladus mixtus (Holmgr.).

N. syn.: *O. arcticus*, Kieff.

N. SPITSBERGEN: Albert Dirkses Bay, Wijde Bay.

16. viii. 23; flying over *Cassiope*-tundra near fresh-water lake; 1 ♂.

Holmgren's type ♀ of *O. mixtus* agrees well with Kieffer's description of *O. arcticus* except in the paler legs, but the specimen is evidently immature, and the legs would no doubt darken with maturity. The above-recorded male conforms to Kieffer's description.

Orthocladus trigonolabis, sp. n.

N. SPITSBERGEN: Albert Dirkses Bay, Wijde Bay, 16. viii. 23, 50 ft.; on boulders by fresh-water lake; 1 ♂; flying over *Cassiope*-tundra near fresh-water lake; 1 ♀.

Colour entirely blackish (♂ ♀), except for the clear yellow halteres; mesonotum scarcely shining, with a slight grey pruinescence on the interspaces. Palpi with four distinct segments, the first half as long as the second, second and third about equal, fourth nearly twice as long as the third. Eyes very widely separated. Last segment of male antennæ nearly one-half longer than the rest of the flagellum, penultimate about as long as broad. Antennæ of ♀ with the second segment constricted near the base, 3-5 rather shortly oval, sense-bristles rather long and slender, 6 longer than 4 and 5 together, with numerous rather short curved sense-bristles and two short terminal bristles. Hypopygium (see figure) remarkable for the shape of the claspers, which are somewhat triangular and strongly produced in the middle of the outer margin. Front tarsi of ♂ without beard, first segment about three-fifths as long as the tibia. Empodium barely one-third as long as the claws in the ♂, nearly half in the ♀. Claws of the ♂ thick and blunt-ended. Wings slightly greyish, finely punctate but without distinguishable microtrichia at a magnification of 300. Lobe not prominent, nearly right-angled. Anterior veins hardly darkened. Costa ending at tip of R_5 ; $f\ Cu$ below base of $r-m$.

The hypopygium is apparently very similar to that of *Trissocladius nigerrimus*, Goet., but the distinctly 4-segmented palpi will exclude the species from *Trissocladius*.

Orthocladus (Dactylocladus) petraeus, var. *ursinus*, Kieff.

N. SPITSBERGEN: middle of S. side of Reindeer Peninsula, 22. viii. 23, 50-100 ft.; on stones and wet moss by stream; 1 ♀.

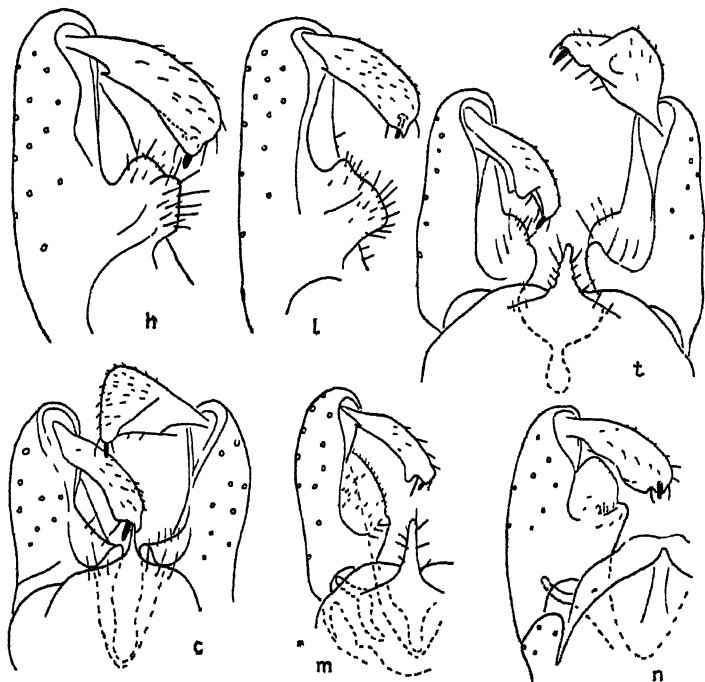
• The specimen agrees with Kieffer's description, except that in the dry specimen the constriction at the base of the

last antennal segment appears more definite and looks like a real joint, in which case the antennæ would be 7-segmented.

Orthocladius (Dactylocadius) novatus (Walker).

Syn.: *Chironomus novatus*, Walker; *Ch. permucor*, Walker; *Orthocladius stercorarius*, auct., p.p. (nec Deg.).

N. SPITSBERGEN: Liefde Bay, 22. viii. 23; under stone between tide-marks; 1 ♂.



Hypopygia of Spitsbergen Chironomidae. h, *Cricotopus humeralis* (Zett.); l, *Trichocladius lestralis*, sp. n.; t, *Orthocladius trigonulabris*, sp. n.; c, *O. ceciformis* (Holmgr.); m, *O. mixtus* (Holmgr.); n, *O. novatus* (Walker).

The male hypopygium is remarkable for the large fleshy lobe of the side-piece, which renders it quite distinct from the other Spitsbergen species. It is abundant in Britain, especially in winter, and I have also seen specimens from the Færoe Is.

Cricotopus humeralis (Zett.).

N. syn.: *Ceratopogon humeralis*, Zett.; *Chironomus ephippium*, Zett., nec Edw.; ? *Chironomus humeralis*, Holmgren.

N. SPITSBERGEN: Albert Dirkses Bay, Wijde Bay,

19. viii. 23; under stones on island in fresh-water lake, 50 ft.; 3 ♂, 1 ♀.

Examination of Zetterstedt's types has shown that his *C. ephippium* is a different and larger species from the British form so identified by Verrall and the present writer. *Ceratopogon humeralis*, Zett., is, however, obviously the same species, and as both names were published in his 'Insecta Lapponica,' the latter may perhaps be adopted. I have little doubt that the specimens above recorded are *C. humeralis*, although the comparison is based only on the female. Holmgren's *Ch. humeralis* from Novaia Zemlya is extremely similar and perhaps identical.

The Spitsbergen specimens of *C. humeralis* rather closely resemble *C. basalis* (Staeg.), but differ as follows:—Size much larger, length 3–4.5 mm. instead of 2–3 mm. Shoulders of ♀ (though not of ♂) distinctly yellow. Hair on scutellum denser but shorter. Hair on abdomen also denser, the posterior margins of the tergites less distinctly shining. Basal lobe of side-piece of male hypopygium quite differently shaped; the whole hypopygium blackish, including the clasper. First segment of front tarsus hardly more than half as long as the tibia; in the ♂ the first three front tarsal segments conspicuously bearded. Pale ring on front tibia of ♀ narrower.

Cricotopus basalis (Staeg.).

N. SPITSBERGEN: S. side of middle of Reindeer Peninsula, 22. viii. 23, 50–100 ft.; on stones and wet moss by stream; 2 ♂, 1 ♀. Albert Dirkses Bay, 19. viii. 23, 50 ft.; under stones on island in fresh-water lake; 1 ♀.

Both sexes agree well with specimens from Jan Mayen and Iceland, and also with Holmgren's types of *C. pavidus*.

Trichocladius lestralis, sp. n.

N.E. SPITSBERGEN: N. Bismarck Str., 3. viii. 23, 0–50 ft., in grass on Skua hummock; 18 ♂, 5 ♀.

Very similar to *C. basalis*, differing as follows:—♂. Last antennal segment relatively a little longer, the penultimate segment slightly broader than long. Whole abdomen moderately shining, the genitalia wholly black; basal lobe of side-piece of a slightly different shape (see figure). Legs wholly black. ♀. Ovipositor brownish yellow. Tibiæ only faintly paler in the middle.

This is very nearly related to *Trichocladius gelidus*, Kieff.,

from Novaia Zemlya, and to *T. nudipes*, Goet., from Belgium, but differs in small details. It seems to be referable to *Trichocladius* rather than *Cricotopus*, though it is rather doubtful if the former should be maintained as distinct from the latter. Zetterstedt's *Chironomus perniger* may possibly be the same species, but the type is immature and not in a fit state for examination.

Metriocnemus obscuripes (Holmgr.).

N.E. SPITSBERGEN: N. Bismarck Str., 3. viii. 23; in grass on Skua hummock; 14 ♂, 5 ♀.

Metriocnemus cataractarum, Kieffer.

N. SPITSBERGEN: Liefde Bay, 28. vii. 23, 50–100 ft., flying in sun over dry tundra; 1 ♂, 1 ♀. Middle of S. side of Reindeer Peninsula, 22. viii. 23, 50–100 ft.; on stones and wet moss by stream; 1 ♀.

Although extremely similar to *M. obscuripes*, this is perhaps distinct on account of a slight difference in the male hypopygium, the lobe of the side-piece being longer, extending over half the length of the side-piece. It is probably only a variety of the species described from Belgium by Goetghebuer as *M. atratulus*, Zett., though this does not agree with Zetterstedt's types. Holmgren's *Ch. transgressus* from Novaia Zemlya (for which Kieffer has unnecessarily proposed the generic name *Chasmatocladus*) also hardly differs.

Metriocnemus ursinus (Holmgr.).

N. SPITSBERGEN: Liefde Bay, 28. vii. 23, 50–100 ft.; flying in sun over dry tundra; 2 ♂; 23. viii. 23, on surface of fresh-water lagoon near shore; 1 ♀. West side of Lomme Bay, 1000 ft., 11. viii. 23 (*T. G. Longstaff*); 2 ♂. Rocky island in mouth of Wahlenberg Bay, 10. viii. 23; on wet muddy fresh-water pond.

W. SPITSBERGEN: Green Harbour, Ice Fiord, 26. vii. 23; flying over damp ground near shore; 1 ♂.

Diamesa arctica (Boh.).

N. syn.: *D. poultoni*, Edw.

All the specimens in Boheman's original series of *D. arctica* are my *D. poultoni*, as are most of those added later by Holmgren, although 2 ♀ of these are *D. ursus*. The species I wrongly recorded as *D. arctica* is possibly *D. walili*, Mg.

Trichotanypus crassinervis (Zett.).

N. syn.: *Tanypus lugubris*, Zett.; *Tanypus frigidus*, Holmgren;
Trichotanypus appropinquatus, Lundström.

This is very similar to the common European *T. culiciformis* (L.), but is much blacker, and the hairs on the wing are much less numerous, being confined to the tip in the male. Synonymy given after examination of types.

Tanypus (s. str.) *barbitarsis*, Zett.

N. SPITSBERGEN: Albert Dirkses Bay, 16.viii.23; on boulders by fresh-water lake; 1 ♂.

This is an interesting new record for the islands.

Trichoceridæ.

Trichocera lutea, Becher.

NORWAY: fairly numerous on the verandah of the Eidsbugaren Hotel at the head of Lake Bygdin, August 1923.

The venation of *T. lutea* is rather variable, and abnormalities are frequent. The exact position of Sc_2 , $r-m$, and Cu_1a is variable; one specimen has a cross-vein in cell R_3 and another has one in cell M_1 . Apart from the shorter and stouter ovipositor, I have not discovered any constant difference in the females between this species and *T. saltator*. Usually *T. lutea* has Cu_1a beyond the discal cell, while in *T. saltator* this is rarely the case.

Trichocera saltator (Harris).

N. syn.: *T. fuscata*, de Meij., Edw., nec Mg.; *T. hiemalis*, Holmgr., nec Deg.; *T. parva*, Boh., nec Mg.; *T. montana*, Brun.

I find on examining Meigen's types of *T. fuscata* in the Paris Museum that they are my *T. major*; the species which de Meijere and I proposed to call *T. fuscata* therefore requires another name, and rather than propose a new one I would suggest the adoption of *saltator*, Harris, which is very likely to have been this species, as it is one of the commonest of the genus occurring in Britain. All the specimens of *Trichocera* in Boheman's and Holmgren's collections belong to this species and not to *T. lutea*. Moreover, I have seen specimens from the Western Himalayas which do not seem to me to be specifically distinct, and I therefore quote *T. montana*, Brun., as a synonym. The British Museum also possesses material from N. America.

XIV.—A Note on the "New Zealand Glow-worm" (Diptera, Mycetophilidæ). By F. W. EDWARDS.

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ONE of the most remarkable insects in the New Zealand fauna is a luminous Dipterous larva which occurs in many parts of the colony in caves, mining tunnels, and dark crevices in rocky ravines. This larva was first described and figured by G. V. Hudson*, who also succeeded in rearing two or three specimens of the adult and thereby proving that the insect was a member of the family Mycetophilidæ; the adults were described by Skuse† as *Bolitophila luminosa*. According to Norris‡, who gave some further account of the insect, the larvæ form a sort of web of slimy threads in dark damp corners, in the centre of the web being a slender tube of mucilage, inside which they can glide rapidly backwards and forwards; one or more threads hang down from the webs on which beads of mucilage are placed. Pupation takes place in the web. Hudson could not state the nature of the food of the larvæ, but thought it might possibly consist of fungi. Norris, on the other hand, definitely stated that the larvæ fed on the remains of small insects which were caught in the web.

These habits are utterly at variance with those of the European species of *Bolitophila*, which feed on the interior of fungi, form no web, and pupate in the ground. The form of the larvæ is also quite different. On the other hand, both the form and habits of the New Zealand larva are in most respects similar to those of species of the genus *Ceroplatus*, and it is noteworthy also that the larvæ of several species of this genus, both in Europe and in Australia, have been recorded as being luminous§. On this account it was suggested to me by the late Dr. D. Sharp that some confusion had arisen and that the luminous larvæ of New Zealand were really those of *Ceroplatus*. When I recently reported this suggestion to Mr. Hudson, he replied that it had already been made long ago by Osten-Sacken, and that in order to

* Trans. N.Z. Inst. xxiii. p. 43 (1891).

† Proc. Linn. Soc. N.S.W. (2) v. p. 678 (1890).

‡ Ent. Mo. Mag. (2) v. p. 202 (1894).

§ This has been stated by Wahlberg for *C. sesioides*, by Skuse for *C. mustersi*, and by Sharp (in conversation) for *C. testaceus*. On the other hand, I have on several occasions reared the larvæ of *C. lineatus*, and have never observed them to be luminous.

satisfy himself that no error had occurred he had repeated his rearing experiments and obtained the same fly.

It would seem therefore that we have here another interesting case of apparently similar larvæ producing quite dissimilar adults, though exactly how close the structural resemblance is between the larvæ of *Ceroplatus* and *B. luminosa* can only be ascertained after a more detailed examination of the latter. The question has often been raised as to whether larval or adult characters are of greater value for classification, in those cases where their use would indicate quite different results. In some cases (as with the Culicidæ and with *Mycetobia*) it has been shown that the larval characters are undoubtedly more important, and that the apparent discrepancy has merely been due to the use in the first place of characters of quite secondary importance for the classification of the adults. In other instances, however (e. g., that of *Trichocera* and *Rhyphus*), no such explanation can be offered, and it does not appear to be applicable to the present case.

In response to my request, Mr. T. R. Harris, of Ohakune, has kindly sent me a specimen of the "glow-worm" found in his district. This larva, however, is unquestionably a *Ceroplatus**, five or six species of which are known to occur in New Zealand. It therefore seems probable that there are in that country at least two species of luminous Mycetophilid larvæ, which may perhaps have been confused by Hudson, and this may possibly account for the differing views of Hudson and Norris as to the nature of the larval food. But assuming, as appears justifiable, that one of these luminous larvæ is really that of Skuse's *B. luminosa*, it is obvious that the species cannot be congeneric with the European species of *Bolitophila*, though without a re-examination of the adult no final conclusion could be arrived at.

The opportunity for making this examination has now been provided by my father, Mr. C. L. Edwards, who, on a recent visit to New Zealand, was fortunate enough to obtain a fine male specimen of the fly in the Waitomo Caves, North Island. This capture was of especial interest, as it was the first example of the species to be received in this country, and perhaps the first to be obtained on the wing in the wild state†,

* Dr. D. Keilin has confirmed my determination of this larva.

† During the last three years I have received several thousands of Mycetophilidæ from various correspondents in New Zealand, representing nearly 200 species, but not a single example of *B. luminosa* apart from the one here recorded.

which is somewhat surprising in view of the abundance of the larva. Mr. G. V. Hudson also kindly lent me his original example, now unfortunately much damaged.

Examination of these two specimens shows that *B. luminosa* resembles the European *Bolitophila*, and differs from all the Ceroplatinæ in the very little swollen pleurotergites and in possessing a well-marked *r-m* cross-vein. Like *Bolitophila* also, it has no combs on the hind tibiæ, while in all Ceroplatinæ except *Macrocera* there are two such combs, one on the outer side and one on the inner. On the other hand, it differs from *Bolitophila* and resembles the Ceroplatinæ (exclusive of *Macrocera*) in having no empodium or pulvilli. I therefore conclude that, although it is probably justifiable to refer the species to the subfamily Bolitophilinæ, it possesses sufficient distinctive characters to warrant the establishment of a new genus, which may be named and defined as follows:—

ARACHNOCAMPA, gen. nov.

Structure of head, thorax, hypopygium, legs, and wings as in *Bolitophila*, except that (1) empodia and pulvilli are both absent instead of well-developed; (2) the radial sector originates far before the middle of the wing, and far before the tip of the long subcosta; (3) the short vein R_4 is absent; (4) the *m-cu* cross-vein is placed slightly beyond instead of much before the base of R_s , and is much nearer to *r-m* than it is in *Bolitophila* (as, indeed, would be the case in Ceroplatinæ if the radio-median fusion had not taken place).

♂Type and only known species, *Bolitophila luminosa*, Skuse.

The name has been chosen to indicate one of the most remarkable characters of the genus—that is, the spider-like habit of the larva, forming webs and using them for the capture of insect-prey. In this respect the insect differs not only from all other Mycetophilidæ but from all other known dipterous larvæ. In the case of *Ceroplatus* and other Mycetophilidæ which form webs, the function of these seems to be either to form a protective covering for the larvæ or by hygroscopic action to assist in forming a moisture-saturated atmosphere, required by some of these larvæ for cutaneous respiration. Moreover, the food of these other larvæ certainly does not consist of insects but of fungus-spores. The web of *Arachnocampa* differs from that of *Ceroplatus* in the presence of the pendent threads, and it has been suggested that these act as "fishing lines"; they are

illuminated by the light of the larva, and small insects being attracted to them adhere to the droplets of mucilage and are captured. Dr. G. A. K. Marshall, who has observed the larvæ at Waitomo, states that when touched the threads are drawn up suddenly into the web.

The locality and circumstances of the capture of the male specimen now in the British Museum are of much interest, and I therefore quote my father's account:—

"9th May, 1923.

"Waitomo, the 'glow-worm,' Caves.

"Our guided wanderings (all the while deep underground) brought us at last to the edge of a pool. Here the guide made a speech about the glow-worms which adorned the roof over the water, pointing out the long glistening threads of a cobwebby texture let down singly by each tiny worm apparently to catch minutæ on the wing. At an engrossing part of the description one of the tourists suddenly produced from under his coat a net, with which he made a sweep at a passing fly, but which caught the guide's acetylene lamp instead and became ablaze.

"However, this glow-worm lecture was only explanatory and preparatory to the great event next coming, to which we were to be introduced under an injunction to perfect silence. Vibrations of air caused by talking or any other sound affected the larvæ, which thereupon put out their lights. This was clearly illustrated by the episode of the net and the commotion it caused. And it might here be said that that tourist afterwards detached himself from the party and stole back alone and unlighted to the unfathomed pool and redeemed his first folly by securing a cave-fly and a number of midges, which no doubt will come under the lens in South Kensington*.

"And now, after due admonitions, and obeying the order to leave all lamps behind, we stepped cautiously in single file down, down to a still lower level. Collecting ourselves at an unseen bottom we held each one his breath, and listened. To each in turn a whisper floated, "Get into the boat." . . . Then gradually we became aware that a vision was silently breaking on us. Either we were moving (though without oars) or a panorama was passing before us. I recollect just noticing the glint of a wire which might have

* [These midges belong to an undescribed species of *Tanytus*. No doubt, they breed in the bed of the river which runs through the cave, and it seems probable they form the main food-supply of the glow-worms.—F. W. E.]

been fastened along the wall of the cave, and on which our dumb boatman might be pulling. But, at any rate, a radiance became manifest which absorbed the whole faculty of observation—the radiance of such a massed body of glow-worms as cannot be found anywhere else in the world, utterly incalculable as to numbers and merging their individual lights in a nirvana of pure sheen.

“And now as to the disposition of this mystic light, which produced itself all unaided in innumerable points. The cave was evidently similar in structure to all the others, giving an endless variety of outline; but whatever was there became dotted over with points of golden light as closely studded as the letters on a printed page, a truer parallel than the glibly quoted starry sky. It did strike me, however, that the higher reaches of the cave resembled the Milky Way. But from those heavens stretched down wondrous stalactites all clothed in living light, and appearing like arms ready to lift one right up to those far-away stars; and not only above the main silent river, along which our noiseless way was truly a gliding, but in branching fjords surprise burst on us again and again revealing fascinating vistas of the same glowing and shapely splendour. To bow the head in adoration of Beauty was but to meet its whole shimmer reflected, unwrinkled, in the quiet river below.”

XV.—*Descriptions and Records of Bees.*—CI.
By T. D. A. COCKERELL, University of Colorado.

Andrena amaguensis, sp. n.

♂.—Length about 7 mm., anterior wing nearly 6·5 mm.

Black, including antennæ and tegulæ; tarsi rufescent apically; the very broad clypeus (with shape of an inverted basin) and lenticular lateral face-marks placed transversely next to clypeus creamy-white; hair of face, cheeks, pleura, and metathorax long, thin, and white, not at all dense on face; hair of vertex dark fuscous, of thorax above sparse and slightly brownish. Legs with mainly white hair, pale yellow on inner side of tarsi. Head broad, quadrate; mandibles falciform, crossing, with an inner tooth, apical part very obscurely reddish; process of labrum narrow, truncate, with long orange hairs springing from beneath it; malar space obsolete, mandibles with no basal tooth beneath; clypeus

polished, with weak widely scattered punctures; front dull and granular, vertex shining, the punctures not dense; cheeks flattened, shining, weakly punctured, no projecting angle behind; third antennal joint very densely punctured, about as long as next two together, fourth shorter than fifth. Mesothorax and scutellum highly polished, sparsely punctured; metathorax entirely dull, the area large and triangular, granular, without evident rugæ (under a microscope it appears cancellate). Wings hyaline, with apex suffusedly dusky; stigma large, red with a dark margin; nervures dark fuscous; second cubital cell small, receiving recurrent nervure about a third from apex. Spurs red. Abdomen fusiform, highly polished, sparsely and weakly punctured, hind margins of segments not evidently pallid; segments 2 to 4 with thin white hair-bands at sides only; venter with white hair.

Kudia River, Amagu Valley, Siberia, July, 1 ♂ (*W. P. Cockerell*).

Closely allied to *A. coitana*, Kirby (*shawella*, Kirby), to which it runs in the tables of Perkins and Schmiedeknecht. It differs by the entirely black flagellum and lack of spots on the white clypeus. This cannot be *A. amurensis*, Friese, which is said to resemble *A. coitana*, but is (male) 9 mm. long and has black hair on mesonotum. It is also distinct from *A. subshawella*, Strand, from Tsingtau.

Andrena semirugosa, sp. n.

♀.—Length about 7 mm., anterior wing 5.7 mm.

Black, including antennæ and legs (small joints of tarsi obscurely reddish); tegulæ rufous, piceous in front and at base; mandibles obscurely reddish at apex; malar space short but distinct; head transverse, ordinary, facial quadrangle about square; process of labrum rather narrow, truncate; clypeus shining but not polished, with very weak and sparse punctures; front dull; facial foveæ seen from above narrow and white; cheeks dull, with the orbits shining; third antennal joint as long as next two together, these of same length; hair of head and thorax scanty and white; mesothorax and scutellum shining, with sparse punctures; metathorax dull, the area minutely rugose (showing vermiform ridges under microscope), poorly defined; mesopleura posteriorly flattened and shining. Wings brownish hyaline; stigma large, ferruginous, without dark margin; nervures rather dilute fuscous; second cubital cell broad, receiving recurrent nervure near or a little beyond middle. Legs with pale hair, tibial scopa entirely white, not large; spurs sordid

white. Abdomen shining, without evident punctures under a lens, segments 2 to 5 with very thin lateral white hair-bands, apical tuft slightly yellowish. The microscope shows the first two abdominal segments entirely covered with extremely minute punctures, running into transverse lines, with a few scattered larger punctures across the middle.

Kongaus, Siberia, August, 1 ♀ (*Cockerell*).

A member of the perplexing group of *A. nana*, Kirby. In the table by Dr. Perkins it runs nearest to *A. alfenella*, Perk., and *A. moricella*, Perk., but differs by the stigma. *A. alfenella* is very easily separated by the much more densely punctured mesothorax and scutellum. *A. nanoides*, Stöckert, from Riedenburg (a species not listed by Perkins, because not British), is a little larger than *A. semirugosa*, and easily separated by the practically black stigma, broader face, black tegulæ, and second abdominal segment conspicuously punctured as seen under a lens. *A. semirugosa* is also very similar to *A. nitidiuscula*, Schenck, having the same sort of stigma; but *nitidiuscula* is easily separated by the dull clypeus, largely red flagellum, and more clearly defined apical impression of second abdominal segment.

Andrena epimelæna, sp. n.

♀.—Length nearly 12 mm., anterior wing nearly 9 mm.

Robust, black, the flagellum narrowly chestnut-red beneath except basally, small joints of tarsi ferruginous; facial foveæ, seen from above, entirely black; head ordinary, facial quadrangle broader than long; mandibles entirely black; process of labrum very broad, slightly emarginate in middle; malar space linear; clypeus somewhat shining, with distinct not very dense punctures, the lower margin with a pair of long fuscous bristles; front rugose, with longitudinal striæ, punctures between the striæ; third antennal joint very long, a little longer than the next two combined; region above top of eyes shining; face and cheeks with sordid white hair, stained with brown at apex of clypeus; vertex with long black hair; mesothorax (except in front) and scutellum with black hair, rest of thorax with dull white hair, but part of the long curved hair at sides of metathorax black; mesothorax and scutellum somewhat shining but not polished, with minute obscure punctures; area of metathorax granular, without distinct sculpture, defined by absence of the long hair which covers rest of metathorax; tegulæ black, minutely rugose, and with short black hair. Wings dusky; stigma slender, red, with a heavy dark margin; nervures fuscous;

second cubital cell broad, receiving recurrent nervure beyond the middle. Femora and trochanters with white hair, hind knees covered with black; anterior and middle tibiæ with short black hair on outer side, spur of middle tibia very long; scopa of hind tibia black on outer side, yellowish white on inner; spurs pale red; middle and hind basitarsi broadened, all the basitarsi with deep ferruginous hair on inner side. Abdomen broad, with a sericeous surface, not evidently punctured, apical depression of second segment not evident; first segment with long dull white hair, segments 2 to 4 with broad dull white hair-bands; apex with black hair.

Okeanskaja, Siberia, Aug. 18 (*Cockerell*), 1 ♀.

In the published tables this runs exactly to *A. denticulata*, Kirby (*listerella*, Kirby), but it is easily distinguished, being much larger, with black flagellum, only narrowly red beneath, and pale hair of thorax not yellowish. The abundant black hair of thorax above readily separates it from *A. quadri-fasciata*, Morawitz, from Turkestan.

Andrena meraca, sp. n.

♀.—Length about 10.5 mm.

Black, of ordinary form; hair of head and thorax greyish white, very faintly yellowish dorsally, labrum with a fringe of chocolate-coloured hair; facial quadrangle broader than long; process of labrum very broadly triangular, roughened above; mandibles very obscurely reddish at tip; malar space linear; clypeus dullish, densely rugoso-punctate, with a median raised line; flagellum very obscurely reddish beneath; third antennal joint about as long as next two together, fourth fully as long as fifth; facial foveæ, seen from above, fulvous, narrowly white along orbit; front dull, excessively densely punctured in middle, finely striate next to foveæ; mesothorax dull, with minute punctures; scutellum polished, sparsely punctured; area of metathorax dull and rugose, hardly defined; tegulæ piceous, rufous posteriorly. Wings reddish hyaline, stigma and nervures ferruginous; second cubital cell receiving recurrent nervure a little before middle. Legs black, with pale hair, light red on inner side of tarsi; hind knees with reddish-chocolate hair; tibial scopa white; spurs pale red. Abdomen broad, not hairy, very finely but distinctly punctured, second segment depressed about a third; segments 2 to 4 with narrow pure white hair-bands, the first broadly interrupted in middle; hair of apex stained with brownish grey.

Kudia River, Siberia, July, 1 ♀ (*W. P. Cockerell*).

In Schmiedeknecht's table this runs to *A. combinata*, Christ, but is easily distinguished by characters of sculpture and pubescence. It is not like any species tabulated by Perkins, but seems to fall in the *A. flavipes* group. On comparison of specimens, however, it is evident that the species is closely related to *A. wilkella*, Kirby, but it cannot go to that species in the table on account of the black hind tibiae and basitarsi. The abdominal punctures are quite as in *A. wilkella*. It is not *A. sibirica*, Morawitz (which is related to *A. combinata*), as that has the thorax fulvous-haired above and the process of labrum emarginate.

Andrena kudiana, sp. n.

♂.—Length about 8·5 mm.

Slender, black, including tegulae, legs, and antennae; hair of face long and black, obscure grey in supraclypeal region, of cheeks black, but long white hair on occiput; hair of pleura greyish black, of mesothorax and anterior part of scutellum black, but of scutellum posteriorly, postscutellum, region of tubercles, and mesopleura anteriorly below pallid; metathorax with black hair; the limits of the black and pale are not very clearly defined or easy to describe; head broad, facial quadrangle much broader than long; mandibles crossing, with an inner tooth; process of labrum shining, broadly truncate; clypeus convex, shining, well punctured; flagellum thick, the joints rather swollen; third antennal joint not nearly so long as next two together, fourth shorter than fifth; cheeks broad, but not toothed or angulate; mesothorax dull, finely punctured, median impressed line very distinct, disc posteriorly shining; scutellum very densely punctured, moderately shining anteriorly; area of metathorax dull and roughened, not clearly defined, slightly plicate at base. Wings dusky hyaline; stigma very dark reddish, nervures dark; second cubital cell receiving recurrent nervure about middle. Legs with light hair, very pale yellowish on inner side of tarsi; spurs pale, faintly reddish; hind tarsi long. Abdomen narrow, highly polished, with piliferous punctures, the surface beyond the second segment beset with erect black hair; thin white hair-bands at sides of segments 2 to 4, on 4 practically entire, the hairs oblique; hair at apex pale grey.

Kudia River, Siberia, July, 2 ♂ (*Cockerell*).

In the British table this runs exactly to *A. bucephala*, Stephens, if the small tooth on inner side of mandibles is ignored, or to vicinity of *A. nigroaenea*, Kirby. It will not

fit anything in the Schmiedeknecht tables. It is really very much like the American *A. nigrihirta*, Ashmead, of which I was strongly reminded at the time of capture.

The following key separates the above species:—

Males.....	1.
Females	2.
1. Clypeus and lateral face-marks white	<i>amaguensis</i> , Ckll.
Face all black	<i>kudiana</i> , Ckll.
2. Small species, about 7 mm. long	<i>semirugosa</i> , Ckll.
Over 10 mm. long	3.
3. Hair at apex of abdomen black.....	<i>epimelæna</i> , Ckll.
Hair at apex of abdomen not black	<i>meraca</i> , Ckll.

Hoplitis monardæ, Cockerell.

♀.—Interstate Palisade Park, near Tuxedo, N.Y., July 6, 1921 (*Cockerell*).

Previously known only from Texas; the present specimen differs only in having entirely black tegulæ. The mandibles are very broad and quadridentate; in *H. graceæ*, Ckll., they are only tridentate.

Halictus japonicus, Dalla Torre.

♀.—Tsuruga, Japan, June 29 (*Cockerell*).

The type was a male, but I have seen the female in the British Museum.

ACANTHALICTUS, gen. nov.

Closely related to *Halictus*, but female with broad head and narrow eyes; mandibles long and massive, strongly tridentate; labrum with an immense apical spine, laterally compressed; scape very long, flagellum short; tongue very short, pointed; labial palpi with four subequal joints, the first three very oblique at apex; maxillary palpi six-jointed, the second joint longest, robust; median groove on anterior half of mesothorax very deep; hind spur minutely denticulate.

Type, *Halictus dybowskii*, Rad., from which the above details are taken.

Acanthaliectus dybowskii (Radoszkowski).

Described from the Amur; I saw authentic specimens (collected by Dybowski) in the British Museum. Last August I had the pleasure of collecting three specimens of this fine species at Kongaus, Siberia.

Acanthalictus griseipennis, sp. n.

♀.—Very near *A. dybowskii*, but differing thus:—Smaller, anterior wing 9 mm.; wings grey (reddish in *dybowskii*); tegulæ entirely black; area of metathorax with longitudinal rugæ, but without the distinct transverse striæ on apical part; first recurrent nervure meeting second intercubitus (joining second cubital cell near end in *dybowskii*).

Kongaus, Siberia, Aug. 9, 1 ♀ (*Cockerell*).

I thought at first to call this a variety of *A. dybowskii*, but it seems to be a distinct species.

STEGANOMUS, Ritsema.

In addition to *S. nodicornis*, Smith, described in Bingham's work, there are in India two very distinct species, the types of which I examined in the Rothney collection at Oxford.

Steganomus gracilis, Cameron.

♂.—Length about 5.5 mm.

Two cubital cells, marginal cell very obtuse; apical joint of antennæ disc-like, enlarged, black, as in *S. nodicornis*. The species is much smaller than *nodicornis*, and the large tegulæ are pale and translucent; the abdomen is black.

Steganomus fulvipennis, Cameron.

♂.—Length about 6.5 mm.

Same sort of antennæ; tegulæ pale ferruginous; abdomen black, strongly punctured (minutely and weakly punctured in *gracilis*); legs dark at base, but beyond that pale clear red, becoming cream-colour on tarsi; mesothorax with short felt-like fulvous tomentum.

Stelis thebaïdis, Friese.

Egypt.

I found the type in Morice's collection. Second recurrent nervure going as far beyond outer transverse cubital as first beyond inner; legs red; abdominal markings cream-colour, not canary-yellow as in *S. signata*, Latr.

PASIPHÆ, Spinola.

P. alismatis (Ducke) and *P. decolorata* (Ducke) are very much alike, but *alismatis* has the thorax finely distinctly punctured; in *decolorata* it is more smooth, with the punctures very minute and weak. Both have red tibiæ and tarsi. *P. bicellularis* (Ducke) has orange or yellowish tegumentary bands on abdomen. I examined these species in the British Museum.

XVI.—*Two new interesting Lemmings from Siberia.* By B. S. VINOGRADOV, Assistant Curator, Zoological Museum of the Russian Academy of Sciences, Petrograd.

SOME time ago I gave a preliminary review of Palæarctic lemmings of the genus *Lemmus*. A full account of this subject will be published in the 'Annals of the Zoological Museum of the Russian Academy of Sciences.' I give here only a brief description of two most interesting forms from Siberia.

Lemmus amurensis, sp. n.

Type.—An adult female. No. 13722. Original number 1. Collected 20th April, 1914, by Ch. Dorogostaisky. Collections of Zool. Mus. Russ. Acad. Sci.

Type-locality.—Pikan, on the Zeya River, tributary of Amour, East Siberia.

Diagnosis.—A very small species: length of head and body in quite adult specimen 96 mm. Skull of about the size of *Myopus* (condylo-basal length 26.2 mm.). Inter-orbital crest rather well developed; brain-case relatively (not absolutely) somewhat larger and more smooth than in other Palæarctic species of the genus, *L. obensis novosibiricus*, Vinogr., excepted. Antero-posterior diameter of interparietal is about $1\frac{1}{2}$ of transverse diameter. Zygomata are not so spreading as in other species. Bullæ tympani relatively large and inflated. The claws on the fore feet more robust than in *Myopus*, but somewhat weaker than in other species of *Lemmus*; palms and soles densely hairy, the rudimentary tubercles of sole completely hidden.

Fur long and soft. Dorsum of uniform nearly "verona-brown" colour of Ridgway (13'' k); a rusty faint shade is perceptible on the dorsum, and particularly on the head and rump; in addition to the dark yellow and dark hairs on the dorsum are spread white hairs (grey at the base); their presence gives to the back a peculiar ash-grey shade. A faint broad dark stripe is marked on the neck and less evident on the dorsum. Sides are of "cinnamon-rufous" colour (11' i), but somewhat lighter. The belly is of uniform "cinnamon" colour (15''), similar to the colour of the sides but paler.

Measurements.—Head and body 96 mm.; tail 10.6; hind foot 14.0; ear 8.2; condylo-basal length of skull 26.2; zygomatic breadth? (probably 18); interorbital constriction

3.3; mastoid breadth 13.7; depth of brain-case 7.8; nasals 7.3; diastema 8.0; maxillary tooth-row 7.2; mandibular tooth-row 7.0.

Observations.—"A swamp near Pikan. Five embryos of the late stadium."—*Ch. I*).

Remarks.—The discovery of this interesting species, sharply distinguishable from other Siberian species, is also an interesting geographical fact, viz., the occurrence of a representative of the Arctic fauna in such a low latitude.

Lemmus obensis novosibiricus, subsp. n.

Original specimens.—Ten specimens. Coll. of Zool. Mus. Russ. Acad. Sci. nos. 11711, 7721, 0728, 11027, 7726, 07. 1904. 1, 7724, 7738, 7728 (skins and skulls), 7722 (skeleton). Collected by Russian Arctic Expedition of 1901–1902, by Yana Expedition of Toll and Bunge and by Hydrographic Expedition of Northern Ocean (1912).

Type-locality.—Islands Kotelny and Liakhov, New Siberian Archipelago, N.E. Siberia.

Essential Characters.—This lemming has some rather important craniological characters distinguishing it from true *L. obensis* (see below). The winter specimens have almost white *Dicrostonyx*-like pelage and very large (not bifurcate) blunt nails.

Diagnosis.—Nasals shorter than in *L. obensis obensis*; when viewed from above they do not cover entirely the nasal aperture. Interorbital crest in fully adult specimens very low or almost absent. Antero-posterior diameter of interparietal about a half of transverse diameter. Zygomatic arches not so spreading as in *L. obensis obensis*. Brain-case large, nearly smooth and rounded even in quite adult specimens. Bullæ larger than in *L. o. obensis*. Upper incisors more prominent forwards. Condylar-basal length of skull as in true *L. obensis*. Zygomatic breadth a little smaller, interorbital constriction and mastoid breadth more; molar teeth heavier.

The summer pelage similar to that of *L. obensis obensis*; ears are more rusty-yellow (near $13\frac{1}{2}$ of Ridgway) than in true *L. obensis*, and sharply contrasted with the colour of the head. The brownish colour of the upper part of head extends to the lips.

The winter specimens have greatly enlarged blunt nails with enlarged corny ungual pads. The winter pelage is very long and silky, coloured in the typical specimens light

Measurements of Lemmus obensis novosibiricus, subsp. n.

	♂. 7724.	♀. 7788.	7725.	♂. 7728.	♀. 7726.	♂. 7721.	7553.	11711.	♂. 67.1904.1.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Head and body.....	125	108	125	115.6	96	....	....	104.2	102
Tail	18.0	8.6	18.0	12.1	12.5	8.8	....	7.8	15.8
Hind foot	18.0	16.8	18.0	16.0	16.0	14.3	....	14.3	17.0
Ear.....	8.0	7.4	8.0	8.6	7.5	6.5	....	6.8	8.0
Condyle-basal length of skull	34.5	32.0	31.4	32.0	30.4	29.7	29.0	....	....
Zygomatic breadth	23.8	21.7	21.2	21.2	20.2	20.0	18.8	....	....
Interorbital constriction	4.5	4.1	4.2	4.4	4.2	4.3	4.3	....	....
Mastoid breadth	18.1	16.4	16.4	16.4	15.7	15.5	15.7	....	....
Depth of brain-case.....	9.5	9.1	8.9	8.6	8.8	8.4	8.7	....	....
Nasella	9.5	8.6	8.2	8.6	7.9	8.2	7.6	....	....
Diastema	11.4	10.7	10.5	10.8	10.2	9.9	9.8	....	....
Mandible	22.6	21.5	21.9	21.8	21.2	20.1	19.6	....	....
Maxillary tooth-row	9.8	9.5	9.5	9.2	8.8	8.1	8.2	....	....
Mandibular tooth-row	9.0	8.8	8.6	8.2	8.6	7.6	7.0	....	....

"pinkish buff" (near 17" *d*, but lighter), with predomination of grey in anterior part of dorsum and on the back. The belly coloured similarly to dorsum, but paler ("cartridge-buff," 19" *f*). Externally the winter specimens of *L. o. novosibiricus* have a superficial resemblance to winter specimens of *Dicrostonyx*.

Remarks.—The peculiar characters of the New Siberian lemming are so important that it would be possible to consider it as a new species, but the presence of specimens with not so sharply developed characters makes me consider this form as a subspecies of *L. obensis*. It is necessary to say also that at the mouth of the Lena River occurs a form of lemming (*L. obensis bungei*, Vinogr. in litt.) which has characters intermediate between true *Lemmus obensis* and *L. obensis novosibiricus*. The above-described form of *Lemmus* has some superficial resemblance to *Dicrostonyx*. I think it is possible to consider it as an appearance of convergence between two forms living under the same conditions of a severe climate of the far northern border of Siberia.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

March 26th, 1924.—Dr. J. W. Evans, C.B.E., F.R.S.,
President, in the Chair.

The following communications were read:—

1. 'The Fossil Elephants of the Upper Thames Basin.' By Kenneth Stuart Sandford, B.A., D.Ph., F.G.S.

In a paper read before the Society on June 20th, 1923, the Author tabulated a succession of the fluviatile deposits of the Upper Thames Basin about Oxford, and referred briefly to the Proboscidean remains which had come to light in the progress of the work.

In particular, *Elephas antiquus* occurred in the Handborough, or 100-foot Terrace, in the Wolvercote Channel, 50 feet (about) above the river, and in the upper part of the 20-foot or Summertown-Radley Terrace.

The Wolvercote Channel is cut in a river-terrace (50-foot or Wolvercote Terrace), which is known to be younger than the Handborough Terrace and older than the Summertown-Radley Terrace; but the exact position, in point of time, of the Wolvercote Channel is not as yet known with certainty.

Elephas primigenius is found in the lower, older, part of the Summertown-Radley Terrace, and apparently in the Sunk Channel Gravels.

In the Handborough Terrace the remains are teeth of *Elephas antiquus* of archaic character, *E. antiquus trogontherii*, and *E. trogontherii*. This is the first recorded instance of remains of elephant being identified in the 100-foot Terrace of the Thames Basin west of the Chiltern Hills, and the presence of *E. trogontherii* in this terrace is noteworthy.

In the Summertown-Radley Terrace the accompanying fauna (*Hippopotamus*, *Corbicula fluminalis*) is found to lie above a cold fauna consisting of *Rhinoceros tichorhinus*, *Bison priscus* (rare), with *Elephas primigenius* (Ilford type) poorly represented and apparently dying out, and *E. primigenius* (Siberian type) prolific. *E. primigenius trogontherii* and *E. trogontherii* have not been identified in this terrace.

In the Sunk Channel a single tooth of *E. primigenius* is once reported¹; this has been rediscovered, and is a rare case of $x27x$ in a third upper molar, with a lamellar ratio of 9.5 and frequency of 10.5: that is, the ridges are very narrow and closely set. The tooth is in excellent preservation, and lay apparently at the bottom of the channel. This suggests a return of the Siberian mammoth; the Sunk Channel is probably of the Reindeer Age: that is, Upper Palaeolithic (by inference only). Reindeer has not been identified in any of the terrace-deposits of the Upper Thames Basin (that is, west of the Chiltern Hills).

The chief object of the paper is to analyse the large collections in the Oxford University Museum, to describe the important Handborough teeth, with their trogontherian forms, and to bring to light the teeth of *E. antiquus*, specimens of Falconer and Leith Adams, which have been identified in the Museum.

2. 'Some Upper Viséan Caninid Corals.' By Herbert Price Lewis, B.A., F.G.S.

An endeavour is made in this paper to lessen the uncertainty which exists concerning the true nature of the Viséan corals of Caninid appearance, by setting forth the results of an investigation into the structure and development of two species of *Caninia*, which the Author has recognized from among these corals.

One species, having a wide distribution in the D₂ beds of North Wales, the Midlands, and the North-Western Province, may be referred to *Caninia* (*Campophyllum*) *juddi* Thomson, if this species be regarded as embracing eight more of Thomson's species of '*Campophyllum*,' including '*Campophyllum*' *cylindricum* Scouler (Thomson, 1893).

'*Campophyllum*' *derbiense* Vaughan MS. is also included in the synonymy, together with certain species of *Caninia* described by Stüekenberg from the Upper Carboniferous of Russia.

The development of *C. juddi* Thomson *emend.* in the early stages resembles that of *Caninia cornucopiæ* Michelin, *emend.* Carruthers, the type-species of the genus, especially in the rhythmic

¹ A. Leith Adams, Monogr. Palæont. Soc. 'British Fossil Elephants' 1877-81, p. 115.

succession of stages with long and with short septa, respectively, which it displays. At a later stage of growth, the species is more akin to the earlier species of the *Caninia cylindrica* group described by Salée (1912). In the ephebic stage the Caninid features are retained.

Changes in fossular appearance due to the late addition of major septa; development of the extrathecal zone, and comparison of the dissepimental arrangement of this zone with that of the outer zone of *C. cylindrica* Scouler, Salée; local development; distribution; and the generic position of the species also receive attention.

Associated with *C. juddi* Thomson in its distribution is a new variety of that species, the varietal features of which are described.

In the other species studied (which is new) the most interesting specific feature is the extrathecal zone, which, as seen in transverse section from an early stage onward, appears to be intermediate in character between the corresponding zones of *C. cylindrica* Scouler, Salée, and *C. juddi* Thomson *emend.* In the development of this new species the late neanic stages (the earliest known) indicate its position in the genus *Caninia*. The species is recorded from an Upper Viséan horizon in Derbyshire.

May 7th, 1924.—Dr. J. W. Evans, C.B.E., F.R.S.,
President, in the Chair.

The following communication was read:—

‘The Silurian Rocks of the Clwydian Range, from Moel Arthur to Gryn.’ By Mrs. Ethel Gertrude Woods, D.Sc., F.G.S., and Miss Margaret Chorley Crosfield, F.G.S.

The Clwydian Range forms part of a complex anticlinal fold of Silurian rocks, folded and faulted into position between the New Red Sandstone of the Vale of Clwyd on the west, and the Carboniferous Limestone of the North Wales Coalfield on the east. The part of the range that the Authors have mapped consists, in detail, of a number of synclines and anticlines of Lower Ludlow age, running nearly due east and west in the north, and more north-west to south-east in the south.

The succession is as follows:—

- Monograptus-leintwardinensis* Zone: Bryn-y-saeson Beds; brightly weathering, banded flags and sandy shales, with *M. leintwardinensis* and *M. leintwardinensis* var. *incipiens*.
- M. tumescens* Zone (2): Cefn Goleu Beds; pale striped flags, yielding *M. tumescens*, *M. dubius*, and *M. crinitus*.
- (1): Eithinen Beds, dark, unbanded mudstones, containing *Dayia navicula*, *Camarotoechia nucula*, *Cardiola (Slava) interrupta*, *Dalmanella elegantula*, and *Encrinurus* sp.
- M. scanicus* Zone (2): Lletty Beds; pale flags and biscuit-like shales, yielding *M. scanicus*, *M. dubius*, *M. crinitus*,

M. uncinatus var. *micropoma*, *M. roemeri*,
M. bohemicus, crinoids, and *Beyrichia*.

- (1): Penmachno Beds; massive sandstones and crushed shales, yielding *M. scanicus*, tiny brachiopods, and crinoids.

Passage-Beds: Teiran Beds; flags, thin sandstones, and crushed shales yielding *M. chimæra*, *M. scanicus*, *M. nilssoni*, and tiny brachiopods.

M.-nilssoni Zone (3): Rhiwieg Beds; flags like 'whetstones', yielding *M. chimæra*, *M. chimæra* var. *salweyi*, *M. varians* var. *pumilus*, and *M. dubius*.

- (2): Bwch-ben-Barras Beds, 'Bluestone' or 'Slab Horizon', flags and shales yielding *M. colonus*, *M. colonus* var. *compactus*, *M. varians*, *M. chimæra*, *M. nilssoni*, *M. dubius*, *M. bohemicus*, *M. uncinatus* var. *orbatus*, *Orthoceras* sp., and *Cardiola (Slava) interrupta*.

- (1): Y Fron-werth Beds, sandy flags yielding *M. vulgaris*, *M. nilssoni*, and *M. varians*.

Of these, the lowest zone represented, that of *M. nilssoni*, is exposed in the western valleys and on the western slopes from the centre southwards. Immediately beneath the mountain-ridge, they are faulted against the alternating sandstones and shales of the *M.-scanicus* Zone. In the centres of the synclines and mainly on the east side of the range, the newer beds of the *M.-tumescens* Zone succeed these, and are again followed by the *M.-leintwardinensis* Zone in one area towards the south-east. The nature of the deposits shows contrasting conditions of deposition, from a still-water, landlocked area, subject to rhythmic changes in the *M.-nilssoni* Beds, to an open-sea, near-shore area with abundance of clastic material in the *M.-scanicus* period; this again is followed by a partial return to earlier conditions.

The beds form part of the pre-Carboniferous floor of North Wales. Subjected as they have been to the strong Caledonian forces, they show many signs, not only of yielding to and resistance to pressure, but also of having moved with a certain amount of individual freedom. The profound influence of the movements is manifested in the well-marked cleavage, the very great crushing to which the more impressionable rocks have yielded, and in the block-like fracturing of the entire range, which has impressed itself markedly on the topography, the chief valleys all running in a Caledonian or sub-Caledonian direction.

The character in the folding which is special to this part of Wales comes out in the Ludlow rocks of the range, and also in the Carboniferous Limestone east of it, the newer faults having reopened along the original lines. The contrasting pitch of the beds in the north and south, and the change in direction of folds and faults, shows that the Moel Famman block (consisting of Moel Famman itself and the region east of it) has acted as a pivotal line, about which the regions north and south have swung, the ~~torsional~~ movement being greater in the south than in the north.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.
[NINTH SERIES.]

No. 80. AUGUST 1924.

XVII.—*On the Post-larval Stage in Diopatra cuprea, Bosc, a Polychæteous Annelid of the Family Eunicidæ.* By
C. C. A. MONRO.

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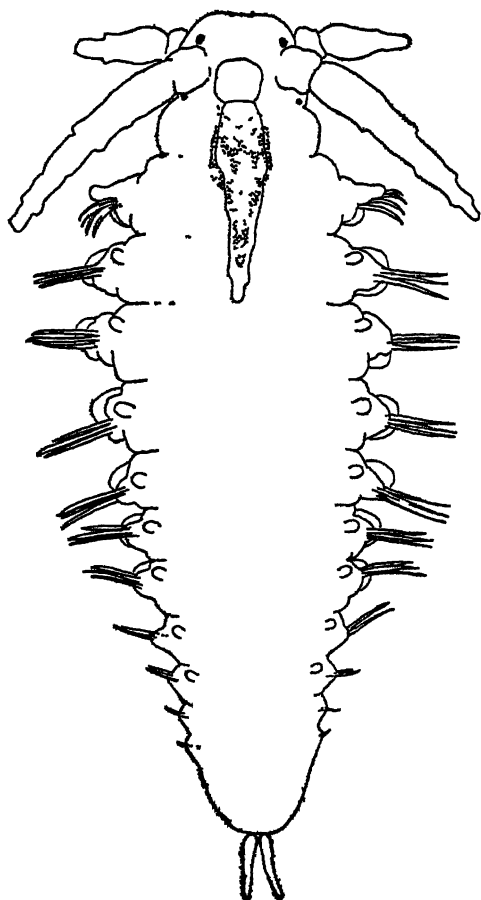
DR. CYRIL CROSSLAND recently forwarded from Madeira the tops of two Polychæt tubes, together with a young worm, some post-larvæ, and some developing eggs. The tubes are of sand, lightly coherent, and Dr. Crossland records by letter that developing eggs, post-larvæ, and a young worm were found inside the tubes, and that the post-larvæ crawled out of the original tubes and began to make tubes of their own. The young worm is 19 mm. long and 1 mm. broad, excluding the feet. Its small size and immature condition make its identification difficult, but its comb-chætæ are those of *Diopatra cuprea*, Bosc, and not those of the Mediterranean species *D. neapolitana*. Augener (1918, p. 350) regards the structure of the comb-chætæ as diagnostic.

Diopatra madeirensis, Langerhans, probably belongs either to *D. neapolitana* or to this species, in spite of the large number of teeth recorded for the jaw-plates.

Descriptions of Post-larvæ.—The post-larvæ, of which there are a considerable number, have an average length of 1.1 mm. and an average breadth of .3 mm., excluding the chætæ

(fig. 1). There are 11 chætigers, the last two feet of which consist of a single chæta just protruding from a rudimentary chæta-sac. The prostomium is subrectangular, and there are five tentacles—an anterior frontal pair, and a median and

Fig. 1



Complete post-larva. The jaws are seen by transparency in rough outline below the median tentacle. $\times 105$.

two laterals situated towards the posterior border of the prostomium. They all have large basal joints or tentaculophores, and the median when laid back just reaches to the third chætiger. The laterals are slightly longer and the

frontals about half their length. There are no buccal tentacles.

There are two pairs of eyes, one anterior and ventral (seen by transparency in the figure) situated on the lower surface of the head internally to the frontal tentacles and a posterior dorsal pair just external to the lateral tentacles.

The first chætiger is apparently biramous, and, besides a short stout dorsal and ventral cirrus, has two small bundles of strong curved capillary chætæ (fig. 2), characterised by

Fig. 2.



Fig. 3.

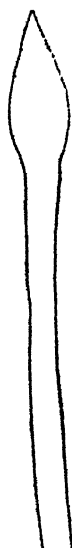


Fig. 2.—Chætæ of second segment. $\times 1900$.
Fig. 3.—Spear-headed chætæ. $\times 915$.

Crossland as digging chætæ. On the following eight segments the dorsal cirri are represented by small clavate knobs and the ventral by rounded prominences. On chætigers 10 and 11 the cirri are not yet developed, and nowhere can I find any trace of a gill. All the feet except the first appear to be uniramous and are furnished with not more than three chætæ. From the second to the fifth foot the chætæ are all of the bilimbate spear-headed type (fig. 3), and on the sixth foot a typical hooded bidentate Eunicid hook appears (fig. 4). The chætæ of the last two feet are not sufficiently developed

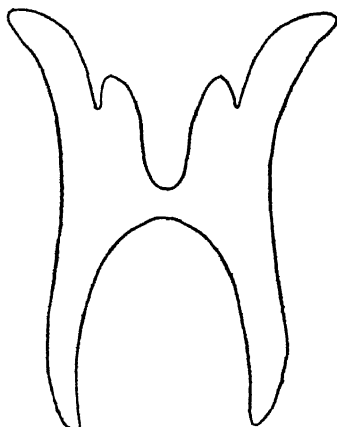
to be characterised. At the end of the body is a pair of stout ventral pygidial styles.

The jaws are already well developed, and their main outline can be seen by transparency through the body-wall. The lower jaw-plates are as shown in the figure (fig. 5). The upper jaws consist of a common basal process, to which are attached a left unpaired plate and a pair of large plates (fig. 6). The left unpaired plate has a strong curved apical fang, below which are 4-5 large teeth. Below these is a row of closely set very small teeth which continue to the point of junction between the unpaired plate and the basal process. The paired plates consist of 12 to 14 serially repeated

Fig. 4.



Fig. 5.

Fig. 4.—Hooded hook. $\times 1000$.Fig. 5.—Lower jaw. $\times 570$.

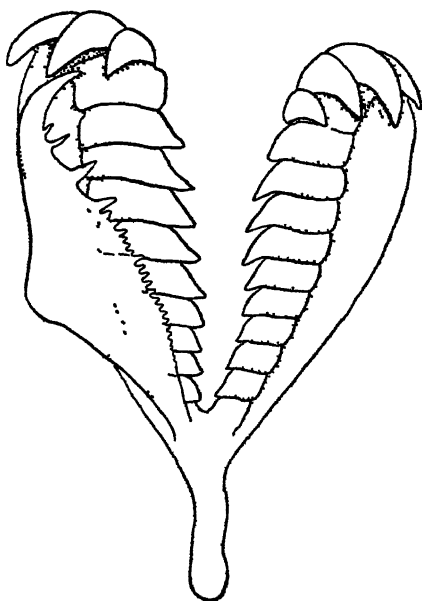
toothed pieces held together on their lateral surfaces by a delicate membranous plate, the presence of which is only discernible with difficulty.

Remarks.—The circumstantial evidence points to the conclusion that these post-larvæ belong to the same species as the young adult, and, on the analogy of various observations made upon the development of Eunicid larvæ (*cf.* Claparède and Metchnikoff, 1869, p. 184; Krohn and Schneider, 1867, pp. 498-508; and Wilson, 1883, pp. 288-291), the absence of ciliated bands and of buccal tentacles, together with the presence of well-developed jaws, places their age at about

three weeks. The jaws of the Eunicid post-larvæ from Madeira, figured by Krohn and Schneider (Taf. xiii. fig. 5), resemble very closely those figured above, but that the two forms belong to different genera is apparent from the fact that Krohn and Schneider's specimens possessed compound chætæ (fig. 3).

Crossland calls attention to the remarkable general resemblance of the jaws in my specimens to those of *Dorvillea**, Parfitt. The series of distinct toothed pieces in the upper jaw-plates show a great general similarity to the condition

Fig. 6.



Upper jaws. $\times 680$

found in *Dorvillea*. That a like condition occurs at a like stage of development in another genus of the Eunicidæ is evident from Krohn and Schneider's figure mentioned above. There is also no apparent reason for regarding the presence of these separate toothed pieces as a special adaptation to a

* Both Chamberlin (1919, p. 339) and Fauvel (1923 b, p. 304) discuss the synonymy of this genus. Fauvel prefers to retain the well-known *Staurocephalus* in spite of its preoccupation. *Dorvillea*, Parfitt, 1866, seems to have priority over the others, as *Prionognathus*, Kieferstein, 1862, is preoccupied by *Prionognathus*, Pander, 1856, in Pisces.

larval or post-larval mode of existence. The conclusion can therefore be drawn that this type of jaw-plate is primitive, and that therefore *Dorvillea*—as far as the jaws go, at least—is nearer to the ancestral Eunicid than any other member of that family.

If this conclusion be correct, we can trace the gradual change in the upper jaw from the simple longitudinal series of similar toothed pieces to the highly complex Eunicid jaws. In *Dorvillea*, as in the post-larval jaws figured here, is found the repetition of a longitudinal series of similar toothed pieces (see Treadwell, 1921, text fig. 448). In *Halla* (see Fauvel, 1923, fig. 169, e) and in *Enone* (*Aglaurides*) (see Treadwell, text-fig. 433) we have a similar repetition of toothed pieces, but differentiation has already begun and these pieces are unlike each other and more complex than in *Dorvillea*.

In *Ophryotrocha* also, besides the forceps, there is a series of toothed pieces (see Fauvel, fig. 180, g).

In *Arabella* (see Fauvel, fig. 175, d) the condition is similar to that in *Halla*. So, too, in *Drilonereis* (see Fauvel, fig. 174, c & k), where the toothed pieces are somewhat simpler. Thus, by a gradual concentration, fusion, and differentiation of these distinct pieces, we pass, perhaps by way of *Lumbrinereis* (see Fauvel, fig. 172, b and h), to the complex condition observable in *Diopatra* and *Eunice*.

Wilson (1881, p. 288) describes and figures the larvæ and young of a Eunicid, which he assigns to *Diopatra cuprea*, at a stage of growth slightly later than that shown by my specimens. His figures (pl. xxi. figs. 91 & 92) represent a stage when the rudiments both of buccal tentacles and of gills have appeared. The chætæ somewhat obscurely figured by him are of a compound or pseudo-compound type, such as do not appear in my specimens. They may, however, be developed at a correspondingly later stage of growth. Andrews (1891, p. 287) states in a footnote that these larvæ and young described by Wilson do not belong to *D. cuprea*, but to *Diopatra magna*, Andrews, which, as Treadwell has shown, is an *Onuphis* [*Onuphis magna* (Andrews), Treadwell, 1921, p. 81]. The grounds for Andrews's statement are not very clear, nor, if Treadwell's interpretation be the correct one, very satisfactory.

Langerhans (1880, p. 290) attributed some young *Diopatra* consisting of 21 to 35 segments and devoid of buccal tentacles to his species *D. madeirensis*, although they and the adult were not found together. As Augener (1918, p. 359) points out, they may belong to his (Augener's) new genus

Epidiopatra, which is distinguished from *Diopatra* only by the absence of buccal tentacles. Augener's genus is founded on small and presumably young (20–30 mm. long) specimens, but it seems very improbable that *Epidiopatra* is merely the young stage of *Diopatra*, because, although the buccal tentacles appear in development at a later stage than either the other tentacles or the dorsal cirri, they appear at an earlier point of growth than that displayed by Augener's *Epidiopatra*.

The presence of the young in the tube of the adult *Diopatra* seems to indicate that in this genus—or, at any rate, in this species—the eggs are laid and the larvæ develop inside the tube of the parent, a phenomenon which to my knowledge has not yet been recorded in this family. Analogous cases of incubation of the eggs and sheltering of the young in the tubes of the adult are, however, known among the Polychæta.

According to Eisig, *Capitella capitata* lays its eggs in its tube, which it does not leave before the young are sufficiently advanced to be able to fend for themselves, and *Nereis dumerilii*, Audouin & Milne-Edwards, behaves in a similar fashion.

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XVIII.—*Reply to Miss Procter's Remarks on the Snake Brachyophidium rhodogaster, Wall.* By Colonel F. WALL, C.M.G., C.M.Z.S., F.L.S.

I HAVE read with much interest the remarks made by Miss Procter in the Ann. & Mag. Nat. Hist. (ser. 9, vol. xiii. p. 141) on the snake described by me under the name *Brachyophidium rhodogaster*, and would like to make further remarks on this interesting Uropelt.

As is well known, the tails and terminal shields of all Uropelts are peculiar, and it is upon these peculiarities primarily that the family Uropeltidæ has been split up into its various genera. When I examined the type of *Brachyophidium* the first points to attract attention were the tail and terminal shield, which differed from those of all previously described Uropelts, and it was on these peculiarities that I based the new genus. A further study of the specimen revealed other points affecting the cephalic lepidosis which did not accord with any known genus.

Miss Procter may be right in her opinion that the presence or absence of a supraocular and a temporal shield is not of generic importance, but I cannot see how the peculiarities of these shields can nullify the very important caudal characters upon which the genus mainly rests.

In *Platyplectrurus madurensis* (the genotype) the tail is round or compressed to a very slight degree. The terminal shield is as broad as high, and ends in a transverse ridge which is as broad as the shield. The middle of the ridge is subspinose, the point being directed slightly upwards. In *Brachyophidium rhodogaster* the tail is markedly compressed at the base, and becomes increasingly so at the tip. The terminal shield is so markedly compressed that it might almost be said to present a rounded vertical dorsal keel, and ends in a point (more prominent in males) directed backwards.

To my mind the differences in the two tails are quite as distinctive as, for instance, the tails of *Uropeltis* and *Silybura*. In spite of Miss Procter's views I adhere, therefore, to my original opinion, that *Brachyophidium* deserves recognition as a distinct genus.

Since reading Miss Procter's note I have acquired nine more specimens of *Brachyophidium rhodogaster*. In all the eye is as shown in fig. 2, a, in her paper—i. e., appears to be in a single shield, as it is in all the fifty-four examples of this snake I have now examined.

It would interest me much to know if the tail of the type of *Platyplectrurus sanguineus* conforms to that of *Platyplectrurus madurensis* or *Brachyophidium rhodogaster*.

XIX.—*Diptera (Cyclorrhapha) from Spitsbergen. Results of the Merton College Expedition to Spitsbergen, 1923.*—
No. 5. By J. E. COLLIN, F.E.S.

THE following notes are supplementary to those published in this Magazine for January 1923, pp. 116–123, and deal with the additional material in this particular group collected in Spitsbergen in 1923. No Empididæ or Syrphidæ were represented in this collection, which, however, consisted of the following :—

Anthomyidæ.

Acroptena frontata, Zett.

1 ♂, Albert Dirkses B., Wijde Bay, 100–200 feet, on flower slope. C. S. Elton, Aug. 17th.

Limnophora hyperborea, Bohem.

1 ♂, 4 ♀ ♀, S. side of Reindeer Peninsula, Liefde Bav, sea-level, flying and settling in sun among *Silene acaulis*. C. S. Elton, Aug. 23rd.

1 ♀, same locality, flying in sun over dry tundra, 0–50 feet. C. S. Elton, Aug. 22nd.

1 ♂, Albert Dirkses B., Wijde Bay, dead on dead grass-stem, about 50 feet. C. S. Elton, Aug. 16th.

Limnophora megastoma, Bohem.

1 ♂, Albert Dirkses B., Wijde Bay, flying and settling in sun over dry tundra, 0–100 feet. C. S. Elton, Aug. 19th.

1 ♂, Cape Roos, S. side of Reindeer Peninsula, Liefde Bay, July 25th.

1 ♀, S. side of Reindeer Peninsula, at sea-level, near shore by Monaco glacier, head of Liefde Bay. T. G. Longstaff, Aug. 24th.

The first male has four or five bristly hairs behind middle tibix (two or three behind and two almost postero-ventral), and probably represents the true *megastoma* of Boheman.

The second male is smaller (very little more than 3 mm.) and has only two bristles behind middle tibix; in this specimen also the second postsutural dorso-central bristle is weak, but the outer cross-vein is practically upright.

The female, which has four pairs of postsutural dorso-centrals, two or three bristles behind middle tibix, and one

small one in front towards tip, appears to be the true mate of first male.

The 1921 material has been re-examined in conjunction with the above, but it does not appear possible to distinguish more than one variable species. That it includes the true *megastoma* of Boheman, originally described from Spitsbergen specimens, is certain; but one cannot help regretting that more material in better condition was not forthcoming.

Limnophora ranunculi, Holmgr. (= *denudata*, Holmgr., teste Stein).

1 ♀ on island off Cape Petermann, near head of Wijde Bay, on dry tundra. T. G. Longstaff, Aug. 20th.

Holmgren described *ranunculi* as having the arista "distincte pubescente" and "fronte vittis duabus antice conjunctis atris, vel vitta unica didyma ejusdem coloris." In the above specimen the arista could hardly be called distinctly pubescent, but the greyish interfrontalia is continued to front of frons, thus dividing the frontalia into two narrow wedge-shaped "vittæ"; this frontalia is rather narrower and the orbits correspondingly wider than in *megastoma*. Epistoma rather less produced. Palpi slightly dilated at tip. Thorax greyish, with three narrow brown stripes, the side ones more or less connected on the outside, with brown patches immediately in front and behind suture. Postsutural dorso-central bristles four in number. Abdomen greyish, with only very faint indications of ill-defined brownish patches; ovipositor terminating in a cluster of small curved spines. Middle tibiæ with two bristles behind only; hind femora long-haired postero-ventrally, and with five or six long bristly hairs antero-ventrally on apical half. Hind tibiæ with three or four small antero-ventral bristles on apical two-thirds and two or three antero-dorsal. Halteres yellowish.

This species is at once distinguishable in the female sex from *megastoma* and *hyperborea* by the spinose ovipositor and the colour of thorax.

MUSCIDÆ ACALYPTRATÆ.

Scatophaga varipes, Holmgr.

8 ♂♂, 3 ♀♀; all except one male taken by Mr. T. G. Longstaff on Aug. 24th near shore by Monaco glacier, S. side of Reindeer Peninsula, head of Leifde Bay, the other male being found on July 28th at Cape Roos, S. side of Reindeer Peninsula.

The curvature of the male hind tibiæ is not always marked, but an additional distinction from *squalida* appears to lie in the weaker, more hair-like bristles mixed with the longer pubescence on male front tibiæ. The darkening of the legs is usually confined to (or, at least, more conspicuous on) the front femora.

Fucomyia frigida, Fln.

A pair. The male taken on Aug. 23rd under stones at edge of Freshwater Lagoon, near shore, S. side of Reindeer Peninsula, Liefde Bay; the female on the next day, flying near shore.

In every respect agreeing with the specimen found in 1921.

Limosina sp.

♀. On ship off Waigat Island, S. end Hinlopen Str., on July 31st.

Possibly only *crassimana*, Hal.

Leria modesta, Meig.

1 ♂, 3 ♀ ♀. The male taken by Mr. T. G. Longstaff on ship off shore, S. side of Reindeer Peninsula, Liefde Bay, on Aug. 24th. Two females, July 31st, on ship off Waigat Island, S. end Hinlopen Str. One female, Aug. 13th, on ship 'Teiningen' off Cape Platen, N. of N.E. Land, Spitsbergen Archipelago.

Previously recorded from Spitsbergen by Boheman under the name *Helomyza borealis*.

Leria septentrionalis, Collin.

3 ♂ ♂, 1 ♀. The males on Aug. 19th, the female on Aug. 18th, on window of hut near shore, 20 feet, Albert Dinkes B., Wijde Bay.

Mr. Elton informs me that there was a colony of nesting glaucous gulls about 2 miles from this hut, and black guillemots and little auks about the same distance.

It appears that the facial "keel" mentioned in the original description of this species is not always evident except between the bases of antennæ.

XX.—On the *Diptera* (other than *Nematocera*) of
Jan Mayen Island. By J. E. COLLIN, F.E.S.

MR. F. W. EDWARDS has published in this Magazine for February 1923, pp. 235–240, an account of the Nematocerous *Diptera* of Jan Mayen Island, including six species additional to those previously recorded from the island by Becher in 1886 (*Österreichische Polarstation Jan Mayen: Insekten*). These additions were found in a collection made on the island by Mr. W. S. Bristowe in the summer of 1921. The other than Nematocerous *Diptera* of this collection were sent to me by Mr. Bristowe for identification, and were found to include five species additional to the two recorded by Becher. With regard to the latter, one (*Homalomyia incisurata*, Zett.) was not found by Mr. Bristowe, the other (*Limnophora arctica*) was described by Becher as a new species peculiar to the island. Through the kindness of Dr. H. Zerny, of the Vienna Museum, I have been able to examine the types of *L. arctica*, and find them identical with specimens of *L. megastoma*, Bohem., collected by Mr. Bristowe.

The seven species mentioned below, added to the fourteen listed by Edwards, make a total of twenty-one species now recorded from the island, of which eleven have been added as a result of Mr. Bristowe's visit.

Tachinidæ.

Cynomyia mortuorum, L.

2 ♀ ♀.

This species has a wide distribution.

Anthomyidæ.

Limnophora (*Spilogona*) *alpica*, Zett.

5 ♂ ♂, 7 ♀ ♀.

Mr. Bristowe informs me that this and the next species were often to be found in flowers, especially of *Saxifraga cæspitosa*.

At present recorded from Northern Scandinavia and the mountains of Central Europe.

Limnophora (*Spilogona*) *megastoma*, Bohem.

1 ♂, 11 ♀ ♀.

A species with a wide distribution in the far north.

As stated above, Becher's *L. arctica* is a synonym of this species. His types are preserved in spirit, and consequently not in good condition for comparison. They have, however, more than three pairs of postsutural dorso-central bristles on thorax, long postero-ventral bristly hairs about base of hind femora, the front mouth-edge projecting as in *megastoma*, halteres of male dusky, of female yellow, and generally agree so well with *megastoma* that I do not hesitate to consider them conspecific. I would refer here to some notes of mine on this and other Arctic species of *Limnophora* from Spitsbergen in this Magazine for January 1923 (p. 119): the Jan Mayen specimens of *megastoma*, however, are more normal than the majority of the Spitsbergen specimens in the number of postsutural dorso-central bristles.

Fannia (Homalomyia) ineisurata, Zett.

Recorded by Becher, but not found on the island by Mr. Bristowe.

Acroptena frontata, Zett.

Three pairs.

A northern species occurring in Greenland, Scandinavia, Spitsbergen, and the mountains of Central Europe (*vide* this Magazine for January 1923, p. 117).

Cordyluridæ.

Scatophaga varipes, Holmgr.

5 ♂♂, 8 ♀♀.

The species of *Scatophaga*, especially the northern forms, are not well distinguished, but the above species, which is closely allied to *squalida*, appears to be common and widely distributed in the Arctic regions (*vide* this Magazine for January 1923, p. 120). Mr. Bristowe found this species to be very common on bird-droppings and dead birds from sea-level to over 1000 feet. The female walked over the medium on which eggs were to be laid with the male on her back, and as she lowered the tip of her abdomen to lay an egg, he gave a little "jab" with the tip of his.

Scatophaga nigripes, Holmgr.

2 ♂♂, 1 ♀.

On bird-droppings round the North Lagoon.

This species has been considered by some writers as a synonym of *S. litorea*, Flin., but the Jan Mayen specimens are darker and longer and darker-haired than in *litorea*. The legs are entirely dark, the male hind femora longer-haired and without any strong bristles, middle femora also without bristles at tip. Acrostichal bristles on thorax longer and rather finer. Holmgren's specimens were from Bear Island and Spitsbergen.

XXI.—*The Genus Chondrilla*. By MAURICE BURTON, M.Sc.,
Research Student of King's College, University of
London.

A VERY extensive and complete survey of the genus *Chondrilla* has been made by Topsent (1918), in which he puts forward very strong suggestions for a revision of its species. In view of the comprehensive nature of Topsent's work, there is little, if any, need to add anything further on the question of species, except to say that examination of a considerable amount of material has shown his suggestions to be perfectly justified. On the question of the removal of certain species to a new genus, for which he proposes the name *Chondrillastra*, however, I do not find myself in such complete agreement, for reasons which I will state later. Meanwhile, I tabulate below a complete list of the species of *Chondrilla*, as here understood, together with short diagnoses thereof.

Genus CHONDRILLA, Schmidt.

Corticate Astrotetraxonida with complex canal system and small flagellate chambers. Without megascleres. Microscleres euasters of one or more kinds.

1. *Chondrilla nucula*, Schmidt, 1862.

Synonymy: *Chondrilla embolophora*, Schmidt, 1862.

Sponge flattened to lobose, varying in colour from white to purplish-brown, and possessing one form of spicule only—viz., spherasters 0.008–0.040 mm. in diam.

Distribution. Almost Cosmopolitan.

2. *Chondrilla australiensis*, Carter, 1873.

Synonymy: *Chondrilla papillata*, Lendenfeld, 1885.
Chondrilla corticata, Lendenfeld, 1885.
Chondrilla globulifera, Keller, 1891.
Chondrilla ternatensis, Thiele, 1900.
Chondrilla australiensis, var. *lobata*, Dendy, 1905.

Sponge encrusting to lobose, greyish-white to reddish-yellow in colour, often with dark specks. Spicules of two kinds: (1) Spherasters 0·019–0·036 mm. in diam.; (2) Smooth-rayed oxyasters 0·020–0·030 mm. in diam.

Distribution. Australia and Indian Ocean generally.

3. *Chondrilla australiensis*, Ctr. var. *mixta*, Schulze.

Synonymy: *Chondrilla mixta*, Schulze, 1877.
Chondrilla distincta, Schulze, 1877.
Chondrilla nuda, Lendenfeld, 1897.
Chondrilla media, Hentschel, 1912.
Chondrilla agglutinans, Dendy, 1916 a.

Sponge encrusting, dark brown to nearly black. Spicules of two kinds: (1) Spherasters 0·006–0·042 mm. in diam.; (2) Oxyasters, with spiny, often branched, rays, 0·024–0·037 mm. in diam.

Distribution. Australia and Indian Ocean generally.

4. *Chondrilla sacciformis*, Carter, 1879.

Synonymy: *Magog sacciformis*, Sollas, 1888 b.
Chondrilla grandistellata, Thiele, 1900.

Sponge encrusting to massive, dark brown. Spicules: spherasters of two kinds up to 0·14 mm. in diam.

Distribution. Mauritius, Ternate, Saya de Malha.

5. *Chondrilla secunda*, Lendenfeld, 1885.

Sponge encrusting or massive, greyish-yellow to dark-blue. Spicules of two kinds: (1) Spherasters 0·060–0·070 mm. in diam.; (2) Oxyspherasters 0·012–0·024 mm. in diam.

Distribution. Port Phillip, Australia.

Carter (1885–6) mentions one kind of aster only in this species. The fact is, I think, the young forms of the larger asters are so like the smaller asters as to be indistinguishable. As proof that two forms are present, the oxyspherasters are present in such quantities as to exclude the possibility of their being all young forms of the larger asters, while, at the same time, immature forms of these

spicules must of necessity be present somewhere, so that one must conclude that they are indistinguishable from the smaller asters (or oxyasphasterasters).

6. *Chondrilla jinensis*, Hentschel, 1912.

Sponge encrusting, grey to black. Spicules of two kinds: (1) Spherasters 0.048–0.056 mm. in diam.; (2) Oxyasters 0.045–0.080 mm. in diam.

Distribution. Arafura Sea.

Topseut (*l. c.*) proposed to divide these species into two groups, according to whether they possessed one or two forms of aster. The former, including *Chondrilla nucula* and *C. sacciformis*, he retained in the genus *Chondrilla*, while for the latter he erected a new genus *Chondrillastra*. Viewed merely from the standpoint of spiculation, such a course might be justified to some extent, but the problem is much more complex than this. From a phylogenetic point of view, such a division is illogical. In the first place, this grouping places *C. nucula* with *C. sacciformis*, with which it has less affinity than with the other species of *Chondrilla*, and separates it from the latter with which it has much in common, for there appears little doubt that *C. nucula* has been derived from a form closely related to *C. australiensis* by the loss of its oxyasters.

That the genus *Chondrilla* has been derived from an *Aurora*-like ancestor has been suggested by Dendy (1916 c), and I see no alternative to this. Thiele has suggested its derivation from *Donatia*, but a comparison of the two genera will readily discredit this. Certainly both have sprung from a *Stellettid* ancestor, and that closely allied to *Aurora*, as now understood.

According to Dendy (*l. c.*) the diagnosis of the genus *Aurora* is as follows: "Stellettidæ in which the principal microscleres are large spherasters (or sterrospherasters) accumulated especially in a cortical layer." The spherasters of *Chondrilla sacciformis* are very similar to the sterrospherasters of *Aurora rowi*, Dendy, while the spherasters of the remaining species of *Chondrilla* more closely resemble the spherasters of *Aurora providentiæ*, Dendy. In the genus *Aurora* the spherasters (or sterrospherasters) show stages of evolution from a *Stellettid*-aster to a *Geodiæ*-aster, and of the two species mentioned above *A. rowi* is certainly the more advanced in this respect. From this reasoning it is seen that *Chondrilla sacciformis* is a later offshoot from *Aurora*

than any of the other species of *Chondrilla*. If any subdivision of the genus *Chondrilla* is to be made, it must surely be one in which *C. sacciformis* is separated from the remaining species of that genus, and not one on an artificial basis of spicule-form in which the details of anatomy and phylogeny are ignored. Possibly it may become necessary, in the future, to revive the genus *Magog*, with an amended diagnosis, for the reception of *C. sacciformis*, but in the present state of our knowledge of both *Aurora* and *Chondrilla*, such action would be premature. The only course open is to abandon Topsent's genus *Chondrillastra*, and deter any subdivision of *Chondrilla* until such time as our knowledge may prove the need for it.

NOTE.—The following four papers contain, together, a complete account of the genus *Chondrilla*, its species and their synonyms, distribution, &c.—also a complete list of literature on the subject. Accordingly, it is to these I refer for further details.

- 1916 a. DENDY, A. "Report on the Non-calcareous Sponges collected by Mr. J. Horneil at Okhamandal, &c." Report to the Government of Baroda on the Marine Zoology of Okhamandal, part 2, pp. 93-146.
 1916 c. —. "Report on the Homosclerophora and Astrotetrazonida, collected by H.M.S. 'Sealark,' &c." Trans. Linn. Soc. London, vol. xvii. part 2, pp. 227-271.
 1877. SCHULZE, F. E. "Untersuchungen über den Bau und die Entwicklung der Spongien. Die Familie der Chondrosidæ." Zeitschr. für Wiss., Zool. Bd. xxix.
 1918. TOPSENT, E. "Les Éponges de San Thomé." Arch. Zool. Expér. et Gén. 1918, t. lvii. fasc. 6, pp. 601-609.

XXII.—*Preliminary Revision of the Family Phryganeidæ, its Classification and Evolution.* By A. V. MARTYNOV (Petrograd).

THE family Phryganeidæ, Burm., contains the largest and most common of our species of Trichoptera which were known for a long time. Nevertheless, their classification is in a very unsatisfactory condition. The division in the genera, proposed by old systematists, was unsatisfactory, and Hagen and McLachlan united all known species into three genera—*Neuronina*, Leach, *Phryganea*, L., and *Agrypniina*, Curt. McLachlan added (1880) a new genus, *Agrypnetes*. This

classification was accepted by G. Ulmer, who added one more new genus—*Linnocentropus*. The genera *Phryganea*, *Neuronia*, and *Agrypnia* are, however, not natural complexes, containing very heterogeneous elements. This was recognised by McLachlan, Ulmer, the present author, and, before them, by Hagen, but neither of these authors proposed another classification. Hagen, in 1873, divided the genus *Phryganea* into four and the genus *Neuronia* into six groups. His six groups of "*Neuronia*" are natural enough, and, with some exceptions and alterations, are accepted here, but I cannot accept the genera *Agrypnia*, *Agrypnetes*, and Hagen's division of *Phryganea*.

Long ago my attention was attracted by the fact that the "genera" *Agrypnia* and *Agrypnetes*, in the structure of ♂ and ♀ genitalia and in some other features, were much more allied to such species of "*Phryganea*" as *P. obsoleta*, *sahlbergi*, *varia* (= *Dasystegia*, Wall.), etc., than the last-named ones to *Phryganea grandis*, *striata*, etc., or to *P. minor*, for instance. The same opinion was expressed by Siltala (1907), who based it on his detailed studies of the metamorphosis. In 1909 I described a new species of *Phryganea*, *P. principalis*, and noted (1909, 1914) that its genital appendages, both ♂ and ♀, are almost identical with those of *Agrypnetes crassicornis*, McLach. It became obvious that the "genus *Agrypnetes*" is quite unnatural. I undertook a comparative study of the genital structures and of other features of nearly all the Eurasian and some American species of the family Phryganeidæ, and my conclusion is that this family must be divided into other and wholly different genera, about 13–15 in number.

Genus 1. PROPHRYGANEA, NOV.

[*Trichostegia*, Kol., part., *Agrypnia*, Curt., *Agrypnetes*, McLach., *Dasystegia*, Wall.]

Type-species, *P. principalis*, Mart.

Anterior wings elongate, discoidal cell of moderate length; in the ♀ the fourth apical fork nearly always present; colouring of the membrane greyish, covered with very dense and more or less brownish primitive net, but the elements of this net are often fused and form some large irregular brown spots; degree of pubescence variable.

♂. Pedes genitales long, two-jointed, basal joint simple, cylindrical, mostly with a prolongation after the base of the second joint, which is more slender and short and clothed

with erect hairs or setæ on the inner side. Xth dorsal segment elongate, roof-shaped; appendices præanales small; penis long, nearly cylindrical.

♀. VIIIth ventral segment forming two lateral projections and a large and long, nearly triangular, subgenital plate with the dilated and bilobed apex. IXth dorsal segment fused with the Xth one and forming a large plate with two ventro-lateral processes and a median projection, which is mostly divided into two small lobes. Live in standing waters.

A rich genus containing about 19 species, as follows:—

- | | | | | |
|---|---|----------------------------------|---|---------------------------------|
| { | { | 1. <i>principalis</i> , Mart. | { | 11. <i>ulmeri</i> , Mart. |
| | | 2. <i>crassicornis</i> , McLach. | | 12. <i>czerskyi</i> (sp. n.) †. |
| | | 3. <i>colorata</i> , Hagen. | | 13. <i>umbrina</i> (sp. n.) ‡. |
| | | 4. <i>straminea</i> , Hagen. | | 14. <i>sordida</i> , McLach. |
| | | 5. <i>pagetana</i> , Curt. | | 15. <i>sahlbergi</i> , McLach. |
| | | 6. <i>curcata</i> , Bks. | | 16. <i>varia</i> , Fabr. |
| | | 7. <i>obsoleta</i> , Hag. | | 17. <i>picta</i> , Kol. |
| | | 8. sp. 2 (see Appendix)*. | | 18. <i>glacialis</i> , Hag. |
| | | 9. sp. 1 (see Appendix)†. | | 19. <i>vestita</i> , Walk. |
| | | 10. <i>impruba</i> , Hag. | | |

The species 1, 2, 3, 4 form a group of closely-related species, *vestita* (19) another group, *glacialis* a third group, and in the remaining species also some little groups of subordinate value can be distinguished ({}).

In the structure of the ♂ genitalia, as well as in the venation and colouring of the wings, this genus possesses many archaic features. The ♀ genital structures are very homogeneous in this genus. The fusion of the IXth and Xth segments and the formation of a long subgenital plate are, on the contrary, progressive features.

Genus 2. PHRYGANOPSIS, nov.

Contains one species—*P. latipennis*, Ulm. (Japan).

In the anterior wings the discoidal cell is rather short and of different form in the ♂ and ♀, first apical sector arising near its end; third and fourth (in the ♀) forks long and sessile; in the posterior wings the discoidal cell has the form resembling that of the anterior wing (♀); 3rd fork long, sessile; colouring and hairiness somewhat resembling those of the foregoing genus.

* = *Phryganea* sp., Martynov, Ann. Mus. Zool. Ac. Sci. St. Pétersb. xiv. 1909, p. 257.

† I have three females from Turkestan, which probably belong to a new species allied to *obsoleta*.

‡ These are new species from South Ussuri-land (see Appendix).

♂. IXth tergite with a median projection, which is coalesced with the long Xth segment; basal part of the pedes genitales short, distal half as long again, consisting of two branches; second joint arising from the basal half, long, slender; in the ♀ there is no long subgenital plate.

Genus 3. NANNOPHRYGANEA, nov.

[*Trichostegia*, Kol., part.; Wall.]

Contains one species—*N. minor*, Curt.

Differing by similar nervation in both ♂ and ♀, smaller size, etc. In the ♂ the Xth segment elongated, broad, with keel-shaped elevation above; basal part of the pedes genitales very broad, robust, distal part slender, stick-shaped, somewhat curved inwards; second joint long, hairy, digitiform; penis thick, short, apical portion curved downwards. In the ♀ the Xth segment conical; subgenital plate large, broad, not very long.

Genus 4. PHRYGANEA, L.

[*Phryganea*, Wall.]

Type-species, *P. grandis*, L.

Anterior wings elongated, with narrow and long discoidal cell; colouring of the wings resembling somewhat that of *Prophryganea*, consisting of primitive net and some spots; pubescence mostly dense; additional (fourth) fork in the ♀ anterior wings present; size mostly large.

♂. Pedes genitales very short; basal joint very thick and short and sometimes divided into two parts; second joint slender, small. Xth segment very short, but sometimes with two long stick-shaped prolongations; appendices præanales very small or absent (as in other genera); penis short. In the ♀ there is a long subgenital plate, but without apical dilatation.

Contains eight species, which can be classified into three independent subgenera (nearly genera).

Subgenus A. PHRYGANEA, s. str.

Posterior wings cinereous-brownish; lower part of the Xth segment in the ♂ forming two long stick-shaped processes (appendices præanales of authors); pedes genitales divided into two portions, second joint not very short, slender, and curved; penis short and thick.

Four species—*grandis*, L., *rotundata*, Ulm., *naterreri*, Brau., *striata*, L.

Subgenus B. COLPOMERA (McLach.).

Posterior wings brownish yellow ; Xth segment with a median projection, bearing two groups of long bristles, but without ventro-lateral processes ; pedes genitales extremely short, reduced ; basal joint not divided into two portions, second joint very short.

Two species—*P. sinensis*, McLach., *P. japonica*, McLach.

Subgenus C. NEOPHRYGANEA, nov.

Posterior wings greyish ; Xth segment consisting of a short median plate and two lateral large portions, bearing some teeth and groups of bristles ; above the penis there are two slender band-shaped processes ; pedes genitales short, but broad, touching each other at the base.

Two North-American species — *P. interrupta*, Say, *P. cinerea*, Walk.

Genus 5. Gen. ?, gen. nov. ?

"*Phryganea*" *californica*, Bks., seems to belong to a distinct genus. . . .

"Wings uniformly blackish fumose, densely clothed with long black and white hair intermixed ; . . . both wings very narrow and almost acute at tips, the outer edge in fore pair being straight, not convex . . . ; first apical sector arising from about middle of (discoidal) cell. . . . One female from California." Genitalia undescribed.

As uniformly blackish wings occur not infrequently in the old complex "*Neuronia*" and not in "*Phryganea*," it is probable that this is not a "*Phryganea*," and represents, perhaps, a distinct new genus.

Genus 6. LIMNOCENTROPUS, Ulm.

One species—*L. insolitus*, Ulm. (Japan, Darjiling).

First apical sector absent in both anterior and posterior wings ; only second, third (stalked), and fifth forms present in both wings (♂ and ♀) ; in the posterior wings discoidal cell elongated, equal to its foot-stalk ; colouring of the anterior wings brownish. In the ♂ the Xth segment very long and narrow, fused in the distal portion ; pedes genitales ascendent, obliquely truncate at the apex, which is directed upwards and inwards. Length of the body 10 mm. This genus differs from all remaining ones by the absence of the first apical sector.

"Genus" *Neuronia* of authors can be divided into the following genera:—

Genus 7. *Holostomis*, Mann., Wall.

Wings almost without pubescence; anterior wings elongated, broad, discoidal cell rather long; fourth apical fork in the ♀ absent: membrane whitish yellowish with blackish-fuscons spots, partly confluent in transverse fasciæ; in the posterior wings of the female third apical fork present; apical margin brownish (one species with black wings).

♂. Ninth ventral segment much broader than the dorsal one; pedes genitales short, two-jointed; basal joint thick and curved inwards, second joint slender, pale; dorsal plate narrow, long; penis with a pair of titillators.

♀. Ventral part of the VIIIth segment as in *Phryganea*; two lateral lobes and a long subgenital plate, narrow in the apical portion. Size large.

Three spotted species—*H. phalænoides*, Uddm., *melaleuca*, McLach., *atrata*, Gmel.—and one black, *H. chinganica*, Mart., which is closely allied to *H. atrata* (fig. 2 b, p. 221).

Genus 8. *Neuronia* (Leach), Wall.

Wings almost without pubescence; in the fore wings discoidal cell rather short, wings broad; in one species (*N. lapponica*, Hag.) fore wings with irregular transverse fuscous bands, in the other (*N. ruficrus*, Scop.) they are blackish.

♂. Dorsal plate (Xth segm.) long, broad at the base, narrowing to the apex; basal joints of the pedes genitales, seen from the side, in the form of large vertical plates with nearly straight hind margin; from the upper margin arise two long and curved slender processes, one of which represents the second joint; penis much dilated in the apical portion, with hind margin truncate; internally furnished with various chitinous incrustations.

♀. VIIIth ventral segment broad, with four digitiform processes.

Two species.

Genus 9. *Oligostomis*, Kol., s. emend.

Type-species, *O. reticulata*, L.

Anterior wings broad with a rather small discoidal cell; membrane yellowish with interrupted transverse fuscous

bands; in the ♀ posterior wings third fork long, but not reaching the anastomosis.

♂. IXth segment broad; Xth segment robust, short, with rows of not long spines at its apex; pedes genitales distantly disposed, one-jointed, short, robust, curved somewhat inwards; penis long, slender, curved downwards, black.

Four species—*O. reticulata*, L., *stålîi*, McLach. (fore wings black), *stygipes*, Harris; *ocelligera*, Walk.

Genus 10. HAGENELLA, nov.

Type-species, *H. sibirica*, Mart.

Habitus resembling that of foregoing genus; colouring of the wings similar.

♂. VIIIth segment broad; Xth dorsal segment short, rather narrow at the base, very broad and plate-like in the apical portion, hind margin bearing paired groups of very long spines; basal joints of the pedes genitales distant, short, but very thick, bulbous; second joint very small, claw- or tooth-shaped; penis very short and thick, with some peculiar plate-like chitinous processes internally.

♀. Ventral part of the VIIIth segment broad, large, with a median excision; IXth dorsal segment small, Xth segment broad.

Four species—*H. clathratus*, Kol., *melanoptera*, Wall. (fore wings blackish), *sibirica*, Mart., *dentata*, Mart. (Sachalin).

Genus 11. REGINA, nov.

Type-species, *R. regina*, McLach.

Anterior wings broad, discoidal cell moderately long, radius feebly curved before the apex; membrane yellow with irregular fuscous bands in the anterior portion of the wing and, mostly, with a fuscous net, partly confluent, in the median and apical portion; hind wings brown or fuscous with a broad transverse yellowish band in the apical half.

♂. Xth dorsal segment rather short, subdivided into two portions by a median excision and an impressed line; pedes genitales robust, one-jointed, sharply narrowing to the apex, which is pointed. Large insects.

Four species—*R. regina*, McLach. (Japan), *mclachlani*, White (India, Himalayas), *reginella*, Mots. (Japan), *pardalis*, Walk. (N. America).

Genus 12. *BANKSIOLA*, nov.

Type species, *B. concatenata*, Walk.

Anterior wings whitish with transverse bands or partly with net (*B. concatenata*) ; discoidal cell rather short.

♂. Xth dorsal segment more broad than long, with long yellowish hairs ; pedes genitales consisting of a thick broad basal joint, bearing one or two more or less long processes, one of which is probably the second joint.

Three species—*B. concatenata*, Walk., *dossuaria*, Say, *smithi*, Bks.

This is Hagen's second group, but I refer to it also *B. smithi*, Banks.

Genus 13. *PTILOSTOMIS*, Kol.

Type-species, *Pt. semifasciata*, Say.

Wings slightly pubescent ; in the ♀ the additional forks present in both pairs ; radius in the anterior wings not bent before the apex ; membrane yellowish with transverse narrow brown stripes, partly confluent ; the spurs of the legs long, the spines rather numerous and long.

♂. Xth dorsal segment with paired processes and long spines ; at its sides there are two long and slender appendages ; pedes genitales placed apart, basal joint large, bulbous, second joint curved or claw-shaped ; IXth ventral segment projecting beyond the bases of the pedes genitales in the form of a plate with hind margin somewhat toothed ; penis with peculiar appendages.

♀. Subgenital plate narrowing to the apex, with two small digitiform hairy appendages.

Four N.-American species—*P. semifasciata*, Say, *postica*, Walk., *ocellifera*, Walk., *angustipennis*, Hag.

Genus ?—" *Neuronia* " *asiatica*, Betten, in its habitus resembles somewhat the genus *Regina*, but seems to represent a separate genus, judging by its ♂ genitalia as they are figured by Betten (pl. xviii. fig. 14*) ; pedes genitales seem to be two-jointed ; anterior wings "orange with brown spots. . . . Hind wing with the basal two-thirds dark brown ; the distal third yellow ; there is an interrupted apical band of brown, the brown spots being on and along the tips of the veins." (Assam.)

* C. Betten, "Notes on the Trichoptera in the Collection of the Indian Museum," Records of the Indian Museum, vol. iii. 1909, pp. 231-242, pls. xiv.-xviii.

Genus ?—" *Neuronia* " *inornata*, Bks., is also unknown to me. It differs from other " *Neuronias* " in " both pairs of wings soiled, whitish hyaline ; faint indications of brown irrorations near veins of anal area of fore wings. . . . Wings rather broad, sparingly clothed with short black hair " (Banks, Proc. Ent. Soc. Wash. viii. p. 117). Genitalia undescribed (Minn., N.A.). Uniformly pale colouring of the wings is a very distinctive feature, but, as the structure of the genitalia is unknown, it is impossible to determine the genus.

Genus ?—" *Neuronia* " *canadensis*, Banks (Canada), is also a " *Neuronia* " of undeterminable position, as the genitalia are unknown, and the same must be said of " *Neuronia* " *apicalis* and *fulvipes*, Mats.

Thus the family Phryganeidæ contains 61 species (fig. 1, p. 218).

In 1907 Professor N. Banks described a new genus *Phryganomyia*, Bks., with two species, *P. alascensis*, Bks., and *P. obscura*, Bks. (Minn.), which the author referred to the family Limnophilidæ. I will remark here that the ♂ genitalia of *P. obscura*, as they are figured by N. Banks*, are very similar to those of *Prophryganea*—namely, the form of the pedes genitales, the character of the IXth segment, which bears tufts of very long stiff hairs, perhaps the form of the penis (from side), resemble closely those in the group of *principalis*. The form of the pedes genitales and of the Xth segment of *P. alascensis*, as they are figured by N. Banks†, also remind one of those of *Prophryganea*. These and some other features (venation) give the impression that the genus perhaps belongs, or is closely allied, to the family Phryganeidæ.

Thus, such species, which were ranked by authors in the distinct genera *Agrypnia* and *Agrypnetes*, must be referred on the structure of the ♂ and ♀ genitalia to the genus *Prophryganea*, together with *P. obsoleta*, *varia*, *ulmeri*, etc., characters of their metamorphosis supporting this view. If it is so, then their general habitus, colouring of the wings, peculiarities of the nervation, and other features, which were treated by authors as being of generic, or even of family, value (*Agrypniidæ*, Wall.), are in reality only some conditions (status), which appeared recently, evolved independently in various species, and cannot be looked on as generic features.

* Proc. Ent. Soc. Wash. viii. 3-4, p. 122, pl. viii. fig. 6.

† Proc. Wash. Acad. Sci. vol. ii. p. 163, pl. xxviii. fig. 16.

The features of this status are as follows:—anterior wings, their discoidal and apical cells narrowing, second transverse costal nervule and additional fork (in the ♀) disappearing, reticulation and spots on the wings becoming feeble and disappearing, spines and spurs on the legs diminishing in number and finally disappearing (spines), joint of anterior tarsus becoming shorter and somewhat equal in size, antennæ and palpi becoming thicker (*Agrypnetes crassicornis*), etc.

All these features bear a regressive character—character of reduction. Now, we know* that such features ordinarily appear under the influence of climatic conditions, namely, under the influence of low temperatures.

The status of *Agrypnia* or *Agrypnetes* are not very alike in various species, and are in obvious dependence on climatic conditions. So East-Asiatic specimens of "*A.*" *picta* (from S. Ussuri-land localities), in their larger size, in the bright colouring of the wings (dark spots, etc.), in the frequent presence of the second transverse nervule in the costal area, in the presence of additional forks in the ♀, etc., resemble considerably such species as *Pr. ulmeri*, *principalis*, *obsoleta*, etc., North-European specimens being more similar to *A. pagetana*. In the last-named species, as also in *Pr. straminea*, the condition of *Agrypnia* is strengthened: second transverse costal nervule and additional forks in the ♀ disappear, colouring becomes paler, spines become less numerous, etc. Nevertheless, all these features are variable enough, and in the Arctic Regions specimens of this species become much smaller, wings narrower, nervation more irregular (loss of some apical forks), colouring paler (pale greyish); the spines on the legs diminish in number and finally disappear, general pubescence disappears, joints of the anterior tarsus become nearly equal, etc. (morpha *hyperborea*). In all these features *P. pagetana* morpha *frigoris* (i. e., *hyperborea*) becomes very similar to "*Agrypnetes crassicornis*," in which the spines almost disappear, antennæ and palps become thick, spur-formula becoming 1.2.2. etc. *Pr. obsoleta* from Arctic localities in some features (smaller size, loss of the hair-clothing, pale colouring of the wings) sometimes is also similar to status of *Agrypnia*.

Without doubt, the status of *Agrypnia* and *Agrypnetes* developed under the long influence of low temperature,

* A. Martynov, "Die Trichopteren Sibiriens, etc. III Teil. Apataniinæ," Ann. Mus. Zool. Ac. Sci. St. Pétersb. vol. xiv. 1915.

i.e., under the influence of the Glacial period. They resemble our *morphæ frigoris*, but differ in that *they are inherited*, that they are, so to speak, "hereditary *morphæ*." Nevertheless, till now they retain some grade of variability.

Thus, our opinion is that the transformation of the status *Prophryganea* into the status *Agrypnia*—*Agrypnetes* was produced by the Glacial period. Formerly, at the beginning of the Glacial period, our species (*Prophryganea crassicornis*, *pagetana*, *curvata*, *picta*, *straminea*, *colorata*, *glacialis*) adopted the non-inheritable rank of true *morphæ frigoris*, but, lately, under the influence of the long duration of the Glacial period, appeared hereditary modifications in the genital cells, with which some somatic changes were associated. Thus, a part of "morphic" modifications became inherited features.

However, not all features of "*Agrypnetes*" *crassicornis* can be counted as the direct effects of low temperatures. A comb-like row of hairs on the median legs and some reduction of the wings must be explained only as adaptations to a semi-aquatic mode of life of the imago, which does not fly. Similar aquatic mode of life adopted by some other species of Trichoptera—*Baicalina reducta*, Mart. (*in litt.*), *Thamastes dipterus*, Hag., *Anomalopteryx chauviniana*, Stein., and many cases support the view that the adoption of such a mode of life occurred in the Glacial period.

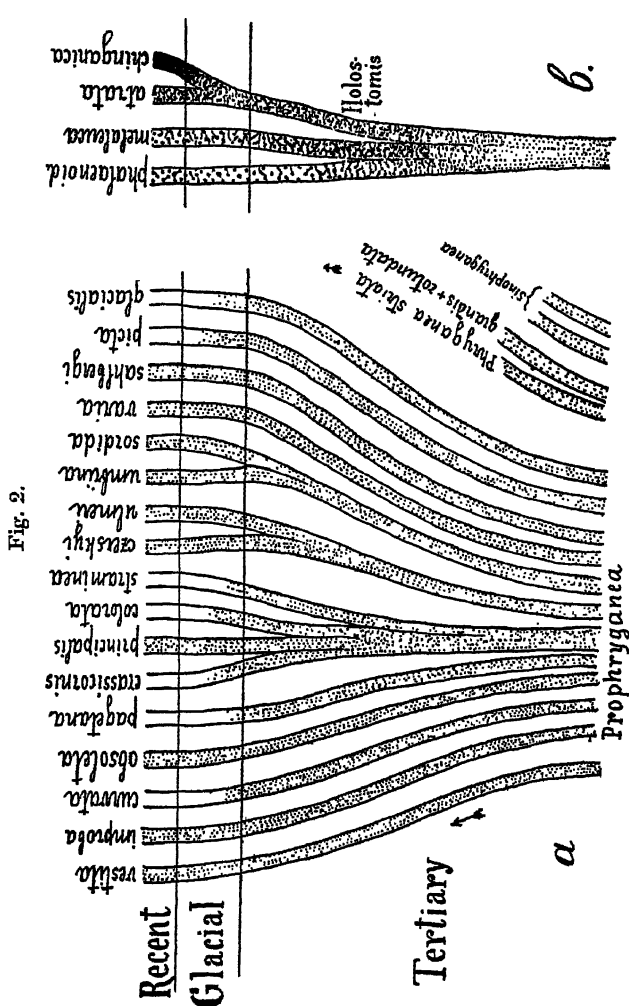
Thus species of "*Agrypnia*" and "*Agrypnetes*," yet in the late Tertiary, before the Glacial period, were not in the state of *Agrypnia*; then they were true *Prophryganea*.

I have no space to consider the evolution of the features of "*Neuronia*," and I will conclude with the following remarks (fig. 2):—

The transverse streaks on the anterior wings of "*Neuronia*" are formed by the strengthening and fusion of some elements of the primary net. Character of such fusions and strengthenings is very variable in various species, supporting the opinion that the process of formation of the streaks and spots in various species (more correctly in specific "stems" or zones) of "*Neuronia*" begin wholly independently and run parallel, giving ordinarily similar colourings in allied genera and species, but sometimes giving very similar colouring in different genera—for instance, in *O. reticulata* and *H. clathrata*. Sometimes from various streaky species arise black mutants (*O. stalii*, *H. melanoptera*, *N. ruficrus*, *H. chingnica*).

The presence of the striation in a great number of recent, as also in some fossil (from the Oligocene), species, indicates

that the tendency to the formation of such streaks existed in a great many rows (vertical) of Phryganeidæ, that it was rather a normal process of evolution of the colouring of the wings, as only few genera—*Prophryganea*, *Phryganea*,



Scheme of evolution of Phryganeidae, as illustrated by *Prophryganea* (a) and *Helostomis* (b). Dotted stems signify evolution of species, which constantly retain the primitive habitus of "*Prophryganea*"; white (undotted) portions signify adoption of the habitus (status) of "*Agrypnin*." b. Evolution of the genus *Helostomis*: three succifeic stems independently and in parallel adopt the spotted and streaky colouring of the anterior wings; c, *higara* is a black mutation from *H. atrata*.

In the structure of the ♂ and ♀ genitalia only one genus (*Prophryganea*) preserved very primitive conditions, the primitive character of its genitalia (in the ♂ especially) being demonstrated by the similarity to such conservative families as Calamoceratidae, Odontoceridae, and, partly, Lepidoceridae (roof-shaped Xth dorsal segment, simple, two-jointed pedes genitales, character of the penis, etc.).

With this fact is correlated, without doubt, such a case that only *Prophryganea* is a rich genus, containing about 19 species, with some groups of closely allied forms, while the remaining more specialised genera, being poor, contain not more than four species, with the exclusion of the genus *Phryganea*; the latter, however, is divided into three independent subgenera, which may be regarded as separate genera (*Phryganea*, s. str., *Colpomera*, *Neophryganea*). Thus we see that the specialised genera died out, and only one more primitive genus flourished in recent times (illustration of Cope's and D. Rosa's laws).

In the females of *Prophryganea* we find some different conditions. The Xth segment is here always fused with the IXth one, which has not yet happened in most "*Neuronia*"; the VIIIth ventral segment always forming a long subgenital plate, a sort of ovipositor—a very useful structure. This process arose in all species of *Prophryganea* in a very uniform manner, and such a phenomenon we cannot compare with diverse specialisations of the ♀ genital segments in the remaining genera. It is a *phenomenon* of some *general progress* in the organisation of the genus, which, in distinction from *true specialisations*, rather *favoured the survival* and flourishing of the genus *Prophryganea*.

The relict genera differ in that they are nearly absent in high latitudes, except *Phryganea striata*, *Neuronia lapponica* and *ruficrus*. On the contrary, many species of the genus *Prophryganea* occur in the Arctic regions or regions with a very cold climate—for instance, in the vicinity of Verchojansk, Siberia, etc. (*Pr. sahlbergi*, *obsoleta*, *pagetana*, *principalis*, *glacialis*, *straminea*). These species, as also *Pr. crassicornis*, *picta*, are eurythermic, and this quality also favoured the survival of many species of the genus *Prophryganea* in the Glacial period.

Thus, not only "*Agrypnia*" and "*Agrypnetes*," but also all genera of "*Neuronia*," formerly had a habitus, resembling very much *Prophryganea* of present times (fig. 2). The males possessed normal two-jointed pedes genitales, roof-shaped Xth segment, etc., as in *Prophryganea*. In the

females the IXth segment was not fused with the Xth one, and the median portion of the VIIIth sternite was not projected into a very long subgenital plate.

Some Remarks on Geographical Distribution.

Twelve species of the genus *Prophryganea* inhabit N. Asia (*principalis*, *crassicornis*, *pagetana*, *umbrina*, *sordida*, *czerskyi*, *ulmeri*, *sahlbergi*, *obsoleta*, *picta*, sp. 1, sp. 2), six occur in N. America, five in Europe, but only *Pr. varia* is a purely European species, allied, however, to *Pr. sordida* and *czerskyi* of Eastern Asia, while the four remaining species (*Pr. pagetana*, *crassicornis*, *obsoleta*, *picta*) are distributed also in Siberia and Mongolia, and can be regarded rather as of East-Asiatic origin. N.-American species occupy Boreal regions, and some of them (*Pr. colorata*, *straminea*) are closely allied to the Siberian *Pr. principalis*. From such cases it can be deduced that the whole genus developed in the East—namely, in the Angara Continent of geologists.

The remaining genera are concentrated in East Siberia and China (19 species) or in N. America (15 species). In Europe 10 species occur, but only 6 species in their distribution are confined to Europe, and of these species *Phr. grandis* and *nattereri* are very closely allied to the Siberian *Phr. rotundata*, *Neuronia ruficrus* to the Siberian (Siberia + N. Europe + N.W. America) *N. lapponica*, *Hag. clathrata* (+ its black mutation *H. melanoptera*) to the Siberian *H. sibirica*. The ancestors of such species as *H. clathrata* and *N. ruficrus* in the late Tertiary migrated probably also from Asia.

In no way can it be concluded that *N. minor* and *O. reticulata* had the same origin. *Nannophryganea* is a separate monotypic European genus; *O. reticulata* (+ its black mutation *O. stalii*) has its relations in N. America (*O. stygipes* and *O. ocellifera*) and indicates probably the ancient land-connection between N. America and N. Europe (North Atlantis). Genera *Holostomis* (four species, one inhabiting also N. Europe), *Limnocentropus*, and *N. (?) asiatica* are Asiatic; genera *Ptilostomis*, *Banksiola*, and some doubtful "*Neuronia*" and "*Phryganea*" (*P. californica*, *N. canadensis*, *N. inornata*) are confined in distribution to N. America.

The genus *Regina* is chiefly East Asiatic, but one species, *R. pardalis*, inhabits the boreal regions of N. America. Two species of *Sinophryganea* inhabit N. China and Japan; the allied subgenus *Neophryganea* is characteristic of N. America.

APPENDIX.

DESCRIPTIONS OF NEW SPECIES.

Prophryganea czerskyi, sp. n.

Prophryganea ulmeri, Martyn. Ann. Mus. Zool. Ac. Sci. St. Pétersb. 1909, p. 236, partim (specimens from S. Ussuri-land and Siberia).

Very closely allied to *P. ulmeri*, Mart.; differing in that the apex of the penis bears about 3-4 pairs of short and slender spines (in *P. ulmeri* it bears two stout long spines crossing each other), and in that the spine-bearing lateral projections of the tenth dorsal segment (♂) are more developed.

Amur-land, Manchuria (Coll. Mus. Zool. Russ. Ac. Sci.).

P. ulmeri, Mart., occurs only in Japan.

Prophryganea umbrina, sp. n.

Very closely allied to *P. sordida*, McLach., differing in that the hind margin of the ninth dorsal segment (♂) is only slightly excised in the middle, apical portion of the basal joint of the pedes genitales seems to be somewhat thicker and second joint slightly shorter than in *P. sordida*.

2 ♂♂ from South Ussuri-land (Coll. Mus. Zool. Russ. Ac. Sci.).

P. sordida, McLach., occurs only in Japan.

Prophryganea, sp. 1.

4 ♀♀ from Perovsk, Syr-Darja, Nikolsky (Coll. Mus. Zool. Russ. Ac. Sci.).

Body dark brown; anterior wings rather broad, truncate at the apex, equably reticulated with brown, without larger spots; R feebly bent before the apex; the structure of the ♀ genital segments resembling much that in *P. obsoleta*.

Perhaps a new species allied to *P. obsoleta*.

Prophryganea, sp. 2.

Phryganea sp. f., Martyn. Ann. Mus. Zool. Ac. Sci. St. Pétersb. 1909, p. 257 (3 ♀♀ from Tsaidam Orient.).

To the description of 1909 it can be added that the structure of the apex of ♀ abdomen resembles more that in *P. czerskyi* (and *P. ulmeri*); tenth dorsal segment with a median fissure in the apical portion; its lateral corners longer than the median ones.

Probably a new species. 3 ♀♀ from Tsaidam and 1 ♀ from Kuku-nor, Kozlov.

XXIII.—Decapod Crustaceans from the Oligocene of Anguilla. By THOMAS H. WITHERS, F.G.S.

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[Plate VI.]

ALTHOUGH Mr. K. W. Earle, F.G.S., brought back during 1923 an extensive series of fossils from the Leeward and Windward Islands of the West Indies, the Decapods number twenty-one specimens only, and these are all from the Upper Oligocene* of Anguilla. The whole of the material collected by Mr. Earle has been presented by the Colonial Office to the Geological Department of the British Museum, and the following is a report on the Decapod remains.

The only fossil Decapods known from Anguilla are three species described by Miss Rathbun (1919, Publ. 291, Carnegie Inst. Washington, pp. 164, 165, 168)—namely, *Callianassa anguillensis*, *C. pellucida*, and *Lyreidus fastigatus*. These all came from the south-western side of Crocus Bay, and in each case are represented by very fragmentary specimens.

The present material came from two localities in Anguilla—namely, Road Bay and Cartouche Bay. Cartouche Bay does not appear to be mentioned on any map or on the Admiralty Chart, but it is almost midway between Road Harbour and Crocus Bay. Mr. Earle informs me also that his specimens were collected from one particular bed, probably from the same horizon in the two localities, as the section is along the strike of the limestone series. In Cartouche Bay the bed is about 3–4 ft. above sea-level.

One of the species described by Miss Rathbun (namely, *Callianassa anguillensis*) is represented in the present collection by several examples of the propodus, and these are more complete than the type-material. The remaining species are new to Anguilla, and include (1) *Scylla costata*, Rathbun, a species hitherto known only from the “lower Miocene” of Santo Domingo, (2) *Calappa earlei*, sp. n., which is closely related to *Calappa flammea* (Herbst), a recent species occurring also in the “lower Miocene” of Santo Domingo and the Pleistocene of the Panama Canal Zone, (3) a chela of a Xanthid crab, resembling very

* See T. Wayland Vaughan, 1919, Bull. 103, U.S. Nat. Mus. p. 585 and table facing p. 595.

closely the genus *Panopeus*, and (4) a merus of a cheliped belonging to a species of *Parthenope*.

This Decapod fauna from Anguilla much resembles that from the "lower Miocene" of Santo Domingo, and suggests that the beds are of similar age.

Order DECAPODA.

Suborder REPTANTIA.

Tribe ANOMOURA.

Superfamily THALASSINIDEA.

Family Callianassidæ.

Genus CALLIANASSA, Leach.

Callianassa anguillensis, Rathbun. (Pl. VI. figs. 3-5.)

1919. *Callianassa anguillensis*, Rathbun, Publ. 291, Carnegie Inst. Washington, p. 164, pl. i. figs. 1-7.

Diagnosis.—A *Callianassa* with the hand subquadrate, a slight ridge one-third the length of the hand extending obliquely from the proximal end of the upper margin on to the inner face and ending in a slight spine; this is followed obliquely by two further spines, one near the distal end and the other midway between it and the first. A group of granules is situated on the outer surface, behind the immovable finger, and a similar group on the inner surface towards the lower half.

Distribution.—Upper Oligocene : Cartouche Bay, Anguilla.

Collection.—Collected by Mr. K. W. Earle, and presented by the Colonial Office to the Geological Department of the British Museum, registered In. 23770—In. 23784.

Material.—Twelve propodi, comprising seven from the left and five from the right side, as well as three dactyli. The propodi range in height from just under 10 mm. to nearly 17 mm. and from a length of 13 mm. to 21 mm.

Description.—Hand subquadrate, almost rectangular in outline, the length slightly exceeding the height, upper and lower margins subparallel, very slightly converging distally. Upper margin slightly convex, almost straight, rather broadly rounded. A sharp raised ridge extends from the middle of the proximal end of the upper margin, is slightly and obliquely inclined to the inner face of the hand, and ends abruptly in a slight spine a little more than one-third

the length of the margin from the proximal end; this spine is followed obliquely on the inner face by two further spines, one standing near to the distal end and the other midway between it and the first spine. All three spines are directed distally. On the outer and inner side of the ridge and the bases of the spines is a row of six small and widely spaced sockets. Lower margin sharp, slightly sinuous, the proximal third convex and the distal third concave, the lower margin of the immovable finger being convex to the tip; the concavity of this margin at the distal half of the hand is more marked in some specimens than in others. A slight smooth-edged rim is formed along the lower margin on the outer face, and immediately above the rim there is a slight concavity in which there is a widely spaced row of about eight small pits. This rim extends well on to the base of the finger and dies out a little beyond. On the inner side of this rim, on the inner face of the hand, there is a close row of tubercles forming a serrated edge, and between the tubercles there is a row of comparatively large sockets opening distally. Outer surface partially covered by slight granules, which are larger behind the base of the immovable finger, where they form a wide group; they become smaller, are grouped lower, and die out towards the proximal end. At the base of the margin of the articulation with the dactylus there is a small group of slight tubercles, separated by a smooth area from the larger group of granules, and the lower half of the margin is finely toothed by tubercles. Inner surface covered on its lower half, except for a smooth area parallel to the lower margin, by slight granules, which become smaller proximally.

Remarks.—This species would appear to be very close to *Callianassa latidigita*, Rathbun (1919, Publ. 291, Carnegie Inst. Washington, p. 165, pl. ix. figs. 10, 11), based on a movable and an immovable finger (holotype) from the "lower Miocene" of Santo Domingo.

Tribe BRACHYURA.

Subtribe OXYSTOMATA.

Family Calappidae.

Genus CALAPPA, Weber.

Calappa earlei, sp. n. (Pl. VI. figs. 6–8.)

Diagnosis.—A *Calappa* like *C. flammea*, but with more prominent and sharply raised tubercles on the carapace, and
15*

with only three prominent flattened spines decreasing in size anteriorly on the postero-lateral margin. The larger tubercles on the hand are prominent, and there is an additional large tubercle near the middle of the hand at the lower margin, in line with three other tubercles forming a longitudinal row as in *C. flammea*.

Distribution.—Upper Oligocene : Cartouche Bay, Anguilla.

Collection.—Collected by Mr. K. W. Earle, and presented by the Colonial Office to the Geological Department of the British Museum, registered In. 23785 and In. 23786.

Material.—The right side of a young carapace extending from the right orbit and including the antero-lateral and postero-lateral borders. A right major cheliped (carpus, propodus, and part of dactylus). The two specimens were found separately.

Measurements.—Length of carapace 18.2 mm. Length of propodus with immovable finger 13 mm., height 12.1 ; both these are slightly incomplete.

Calappa flammea (Herbst) is a recent species of box-crab ranging from North Carolina to Colombia and Venezuela, occurring also at Bermudas and the Cape of Good Hope. It has been recorded by Miss Rathbun (1918, Bull. 103, U.S. National Museum, p. 157, pl. lxi. figs. 4, 5) from the Pleistocene of the Panama Canal Zone and (1919, Publ. 291, Carnegie Inst. Washington, p. 169) from the "lower Miocene" of Santo Domingo. These fossils, however, consist merely of the fingers, and the Santo Domingo form may belong to the present species. Although fragmentary the present material is much more complete than the known fossil specimens, comprising, as it does, the right side of a carapace and a right major cheliped. These show that the form is undoubtedly close to *C. flammea*, although exhibiting differences, and more complete material would probably add to the differences.

So far as the carapace is concerned, the characteristic tubercles on the surface are much more prominent and sharply raised ; there are only two prominent flattened spines instead of three in front of the large spine forming the postero-lateral angle of the carapace, and the surface-ornament appears to be finer and sharper. On the outer surface of the hand the larger tubercles are rather more prominent, and, in addition to the tubercle a little removed from the strong submarginal tooth or lobe of the immovable finger, there is another strong tubercle. This is situated near to

the basal margin, and forms an oblique line with the distal tubercle and the spine (broken off in the specimen) at the proximal extremity of the lower margin. It also forms the basal of four tubercles extending obliquely and longitudinally down the middle of the hand.

Subtribe *BRACHYGNATHA*.

Superfamily *BRACHYRHYNCHA*.

Family *Portunidae*.

Genus *SCYLLA*, de Haan.

Scylla costata, Rathbun. (Pl. VI. figs. 1, 2.)

1919. *Scylla costata*, Rathbun, Publ. 291, Carnegie Inst. Washington, p. 170, pls. iv., v. pl. vi. figs. 3-5.

Diagnosis.—A *Scylla* with the hand having three blunt costæ on the outer face. The hand apparently becomes more quadrate in old specimens, the upper costa more prominent, the concavity above the upper costa more pronounced, and the spine or lobe overlapping the dactylus more produced.

Distribution.—Upper Oligocene: west side of Road Bay, Anguilla.

Collection.—Collected by Mr. K. W. Earle and presented by the Colonial Office to the Geological Department of the British Museum, registered In. 23768 and In. 23769.

Material.—A nearly complete left minor chela and part of the immovable finger of a right chela.

Description.—Propodus with the upper and lower margins subparallel, converging only slightly proximally. Height (greatest) of hand 43 mm., length of upper margin 39 mm., length of middle of hand 50 mm., thickness 25.5 mm. The lower proximal end is incomplete. Upper margin gently convex, broadly rounded, the proximal end broadly rounded off, the distal end somewhat flattened on the outer face, with a large spine (broken off in the specimen) at its upper distal extremity. Lower margin transversely very convex. The hand is costate, having three strong, but blunt, costæ on the outer surface, the two upper costæ being the more prominent, the three costæ dividing the hand into four almost equal areas. The upper costa begins at the tooth at the articulation with the carpus, is slightly concave upwards, and ends in a distally projecting lobe just above a large protuberance at the lateral articulation with the dactylus;

from this costa to the upper margin the surface is comparatively deeply concave. The middle costa is almost straight, is directed towards the sinus between the fingers, but does not extend to it; between this costa and the upper costa the surface is flattened, and below it the surface slopes rapidly and is slightly concave to the lower costa. On either side of the hand at its articulation with the dactylus there is a large, smooth, rounded protuberance, the one on the inner face being more prominent, but both are bounded prominently by a deep narrow furrow; below each protuberance, and distal to it, is a thick acutely rounded lobe, overlapping the dactylus, but that on the outer face is more acute and forms a spine. Inner surface somewhat flattened, but the middle of the hand is bluntly rounded and prominent, and ends in a large distally directed spine near to the sinus between the fingers.

On the immovable finger the prehensile teeth are very unequal, flattened laterally, smoothly rounded, the tips dark-coloured; there are three large teeth almost equally distant from each other, and between them are three or more smaller teeth, except on the proximal side of the large basal tooth, where there are two small teeth, one on either margin. Below the base of the teeth on the inner face there is a single row of small but unequal punctæ. A similar row of punctæ, but more closely arranged and more prominent, is situated near to the middle of the immovable finger, and this dies out towards the base of the finger. Two single rows of punctæ, but less pronounced, are seen on the outer surface. The large basal tooth of the dactylus is not markedly directed inwards, and although very large this propodus no doubt represents the minor chela.

Remarks.—The present propodus has caused me some trouble, for, although it is undoubtedly near to *Scylla costata*, Rathbun, from "probably lower Miocene" of Santo Domingo, I could not satisfy myself from the type-description and figures whether it belonged to that species or not. On sending my notes and photograph to Miss Mary J. Rathbun, she also was puzzled, and very kindly took the trouble to make a re-examination of the type, which is in the Academy of Natural Sciences, Philadelphia.

Our specimen agrees with *S. costata* and differs from other species in the presence of three strong but blunt costæ on the hand. It differs from the holotype of *S. costata* mainly in being very much more quadrate, the costæ, especially the upper one, are more prominent, with a deeper concavity above the upper one, and the finger is much broader vertically.

It is, however, very little, if at all, longer than the hand of the minor chela of the holotype of *S. costata*, but it has a greater vertical height, especially towards the proximal end.

In the recent *Scylla serrata*, de Haan, there is a tendency for the hand to become more quadrate in old specimens, although not to the extent seen in the present specimen, but it may be that this feature in this individual is somewhat accentuated. The width of the finger also appears to vary in *S. serrata*, but this appears to be due more to station than to age. This leaves the strength of the costæ, which even varies in the type-material. While in the smaller paratype (1919, pl. vi. figs. 4, 5) the upper costa is hardly prominent, in the holotype (1919, pls. iv., v.), which represents an older individual, the upper costa is quite prominent with a slight concavity above, thus leading on the present specimen.

Altogether then it seems advisable to refer our specimen to *S. costata*, Rathbun, which must be regarded as a variable species.

The fragmentary immovable finger from the Oligocene of the Panama Canal Zone, described by Miss Rathbun (1918, Bull. 103, U.S. Nat. Mus. p. 164, pl. lxxv. fig. 7) as *Callinectes* sp., is very like the present form.

Family Xanthidæ.

Panopeus sp. (Pl. VI. fig. 9.)

Diagnosis.—A Xanthid crab with the hand short and not very stout, distal end vertical, proximal end very oblique, with a slight ridge extending the length of the middle of the outer face, and with two deep grooves on the outer face of the immovable finger. Outer and inner surface covered with reticulate markings.

Distribution.—Upper Oligocene: Cartouche Bay, Anguilla.

Collection.—Collected by Mr. K. W. Earle, and presented by the Colonial Office to the Geological Department of the British Museum, registered In. 23787.

Material.—A single small right propodus.

Description.—Propodus with the hand short but not very stout (length of upper margin 5.8 mm., length of lower margin 7.6 mm., length including immovable finger 11.3 mm., height 6.3 mm., thickness 3.3 mm.), distal end vertical, proximal end very oblique. Upper margin convex, rather broad and flattened, slightly grooved from end to end, with a slight spine at the proximal extremity; lower margin convex, sharply rounded, with a strong spine at the

proximal extremity. The outer edge of the articulation with the carpus stands at a much lower level from the rest of the surface and is separated by a deep groove. Outer surface moderately convex vertically, and slightly convex from end to end, with a slight ridge extending transversely down the middle of the hand. Immovable finger short, with a deep groove with punctæ on the outer face towards the lower margin and a similar groove at the base of the teeth; similar but shallower grooves with punctæ are seen on the inner face, and on both faces there are a few scattered punctæ. The teeth are not preserved. The inner surface is slightly humped in the middle, and a wide deep concavity surrounds the margin of the articulation with the carpus. Outer and inner surfaces ornamented with reticulate markings.

Remarks.—A tip of a finger belonging to an indeterminate species of *Panopeus* has been described by Miss Rathbun (1919, Publ. 291, Carnegie Inst. Washington, p. 179), from the "lower Miocene" of Santo Domingo. This may be conspecific with the present form.

Superfamily OXYRHYNCHA.

Family Parthenopidæ.

Parthenope sp. (Pl. VI. fig. 10.)

A single merus of a right cheliped would appear to belong to the genus *Parthenope*, and agrees very well with the recent species *Parthenope affinis* (A. Milne-Edwards), 1872, Nouv. Arch. Mus. Hist. Nat. Paris, tom. viii. p. 261, pl. xvi. fig. 4.

Distribution.—Upper Oligocene: Cartouche Bay, Anguilla.

Collection.—Collected by Mr. K. W. Earle, and presented by the Colonial Office to the Geological Department of the British Museum, registered In. 23788.

Description.—Merus elongate (length 27·7 mm., width of inner or lower surface 7·1 mm., thickness 4·7 mm.), subtriangular in section with the angle rounded, the proximal end bevelled off from the inner surface. Lower surface flattened, somewhat concave, the inner margin sharp-edged and furnished with from twelve to fourteen unequal spines, and there are several unequally distributed spines at or near its upper margin. Outer surface angularly bent into two unequal portions, the anterior portion being the narrowest, both surfaces being convex, and the angle formed by the two sides is rounded and furnished on its anterior edge with

several small blunt tubercles, the anterior surface also having a few similar tubercles.

Remarks.—Species of *Parthenope* have been described by Miss Rathbun (1919, Publ. 291, Carnegie Inst. Washington, pp. 180, 181) from the "lower Miocene" of Santo Domingo, namely, *Parthenope (Platylambrus) obscura*, Rathbun (pl. vii. figs. 5, 6), and *Parthenope*, sp. indet. (pl. vii. figs. 8, 9). These are represented by dactyli.

EXPLANATION OF PLATE VI.

Scylla costata, Rathbun.

Fig. 1. Left minor chela. Outer view. In. 23768. Nat. size.

Fig. 2. Inner view of same.

Callianassa anguillensis, Rathbun.

Fig. 3. Left propodus. Outer view. In. 23770. Nat. size.

Fig. 4. Inner view of same.

Fig. 5. Left propodus. Outer view. In. 23771. $\times 1.5$ diam.

Calappa earlei, sp. n.

Fig. 6. Carapace (right side). Outer view. Holotype. In. 23785.
 $\times 1.5$ diam.

Fig. 7. Right cheliped. Outer view. In. 23786. $\times 1.5$ diam.

Fig. 8. Inner view of same.

Panopeus sp.

Fig. 9. Right propodus. Outer view. In. 23787. $\times 2$ diam.

Parthenope sp.

Fig. 10. Merus of right cheliped. Inner view. In. 23788. Nat. size.

XXIV.—On a new Species of Fresh-water Amphipod, *Carinogammarus annandalei*, sp. n., from Algeria. By TH. MONOD (Muséum d'histoire naturelle de Paris).

IN October 1921, the late Dr. N. Annandale collected, in a little stream between Setif and Bordj bou Arreridj (Algeria), a few specimens of an Amphipod, which he presented to the British Museum.

Dr. W. T. Calman, when examining the African Gammarid found that it showed close relationship to *Carinogammarus roeselii* (Gervais), a common European species, but differed from it in a very conspicuous character, the

shape of the inner branch of the third uropod. That inner ramus is reduced to a mere scale, a feature which, curiously enough, is quoted in the diagnosis of *C. roeselii* by T. R. R. Stebbing 'Tierreich,' Gammaridea, p. 505): "Uropod probably as in *C. caspius*," i. e., "inner ramus scale-like, half as long as peduncle."

This statement cannot be retained, since the specimens of *C. roeselii* in the British Museum (from Central Europe and France) have a long inner ramus (the rami are subequal in ♂, the inner one slightly shorter in ♀).

M. Chevreux, after examination of a specimen of the Algerian *Carinogammarus*, is inclined to think—in view of the importance of the characters found in uropods—that one has to deal with a new species.

Dr. W. T. Calman very kindly put into my hands his valuable specimens and gave me all the required information about them.

Carinogammarus annandalei, sp. n.*

Diagnosis. *Carinogammarus roeselii* (Gervais) et *C. caspio* (Pallas) sat affinis sed a sequentibus conspicuis notis facillime distinguendus: ramus interior tertii uropodarum paris maxime reductus, subovalis, scaliformis, quam pedunculus multo brevior (1:2); dentes dorsales non solum acutæ sed longitudinale latæ; dens ultimi thoracici segmenti bene evoluta, denti primi abdominalis segmenti fere æqualis; segmenta abdominalia 4-5 tuberculo dorsale nullo instructa.

Description:—

Length. 7-9 mm.

Cephalon. No distinct rostrum; infra-antennal angle acute.

Eyes. Reniform, black.

Peræon. Last segment dorsally produced to a conspicuous tooth, similar to the teeth of the 1-3 pleon segments. Side plates 1-4 rather deep, 4th the largest with the posterior margin feebly emarginated.

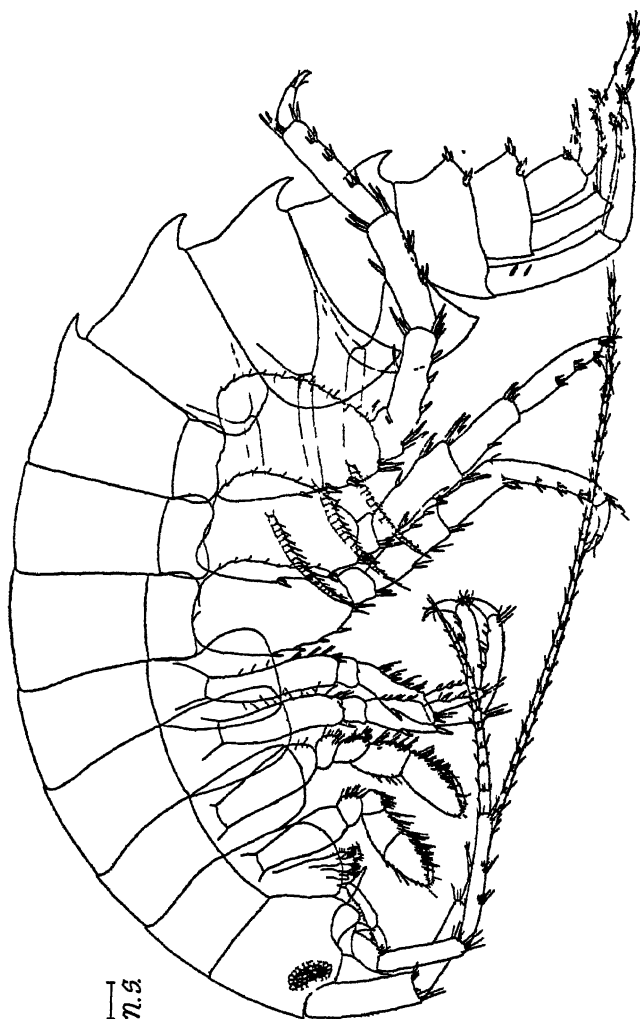
Pleon. Segments 1-3 dorsally produced to a carinate tooth, longitudinally widened; segments 4-5 with a little dorsal spiny elevation, and a small group of spines on either side; segment 6 with two subdorsal groups of spines; segments 2-3, postero-lateral corners acute.

Telson. Cleft to the base, lobes divergent, with a proximal external spine on either side, and apical spines and setæ.

* The specific name is chosen in memory of the collector, the late distinguished Director of the Zoological Survey of India.

Antennulæ. Slender, about as long as the body; each peduncular joint shorter than the preceding one; accessory flagellum 3-jointed, 3rd joint minute; main flagellum much longer than peduncle, 23- to 27-jointed.

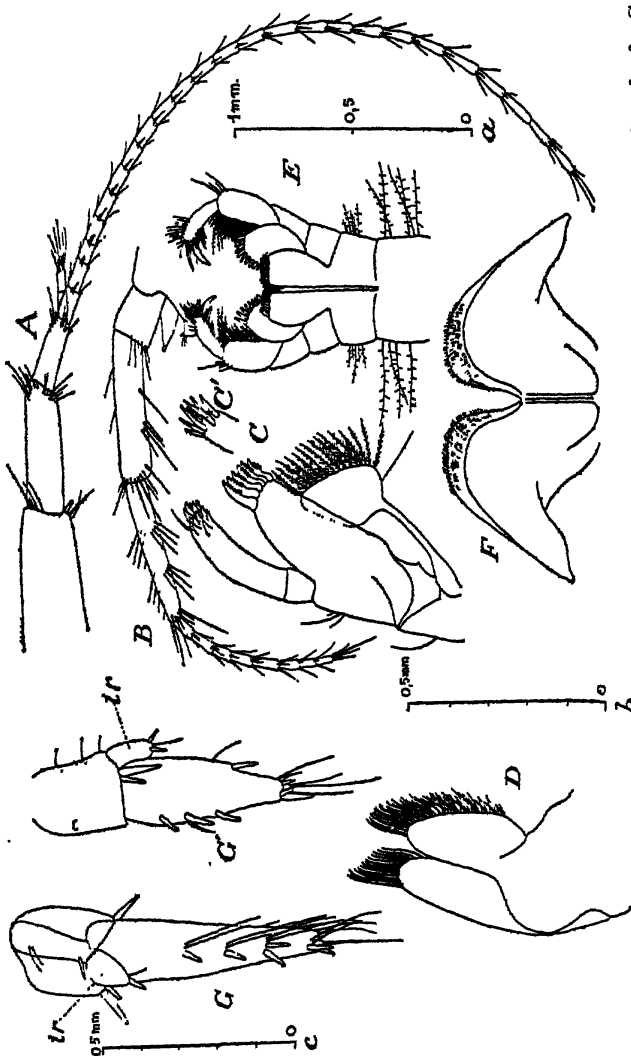
Fig. 1.



Carinogammarus amandalei, ♂, from the side.

Antennæ. Much shorter than antennulæ; last peduncular joint longer than penultimate; flagellum 8- to 12-jointed.
Mandibula. Normal.

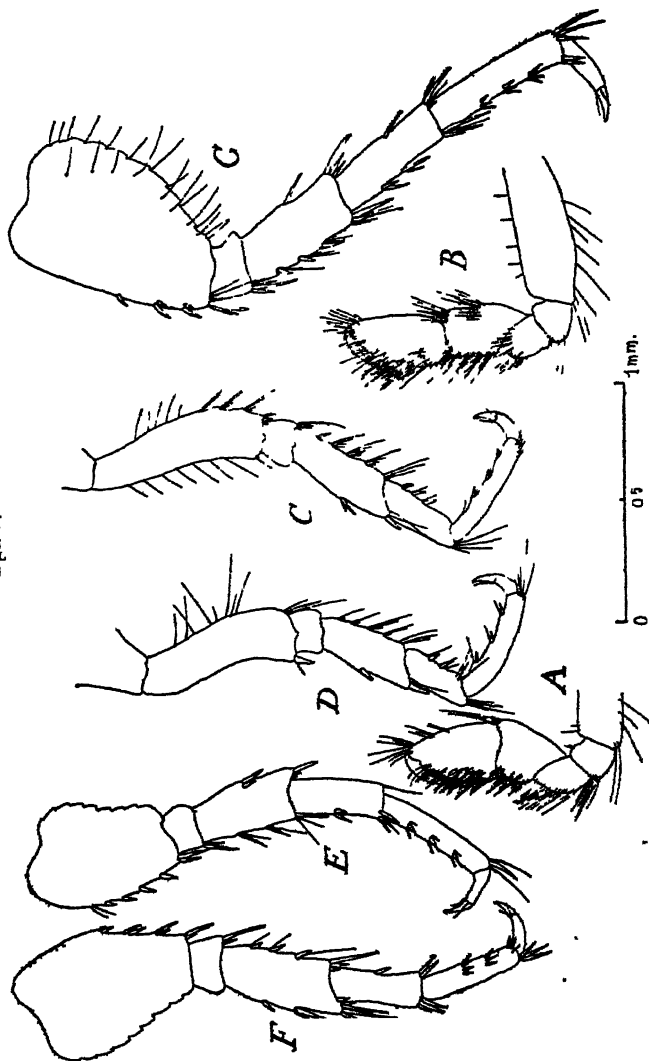
Fig. 2.



Carinogammarus amundensis, ♀. (N.B.—The length-scale *a* is intended for A, B, E, *b* for C, D, F, and *c* for G, G'.)
 Antennula. B. Antenna. C. Maxillula. C'. End of palp of the other maxillula. D. Maxilla. E. Maxilliped. F. Lower
 uropod. G. Third pair of uropods (♂) : *b* = reduced inner ramus. G'. Ditto (♀).

Maxillula. Normal; 2nd palp-joint tipped with broad short spines or rather slender ones on the palp of the other side; first inner lobe oval carrying feathered setæ; second lobe tipped with large serrated spines.

Fig. 3.



Carinogammarus annandalei, ♀.

A-B. First and second gnathopoda. C-G. First to fifth pereopoda.

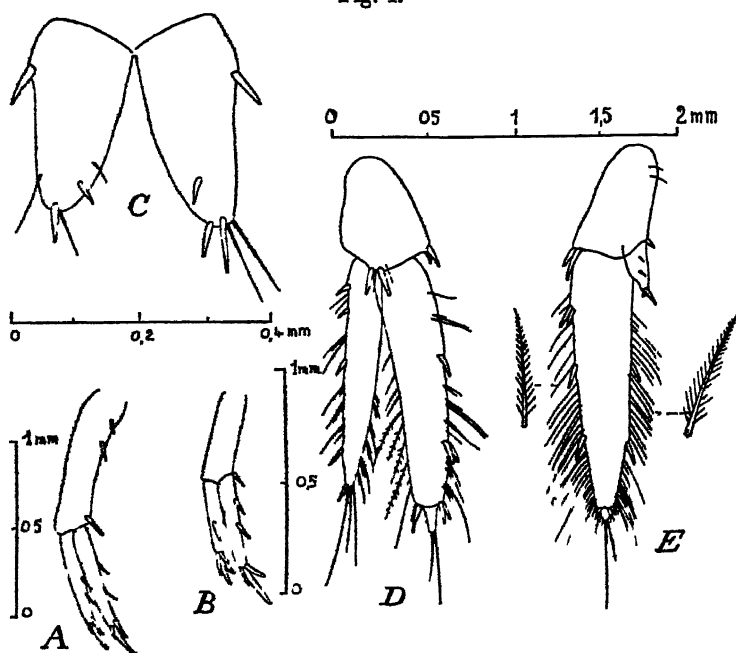
Maxilla. Normal; the two lobes subsimilar, oval, the outer one having only apical setæ, the inner one apical and internal.

Lower lip. Bilobed, covered with short hairs.

Maxilliped. Normal; 3rd joint of palp slightly curved and distally widened.

Gnathopod 1. Carpus cup-shaped, roughly triangular; propodus pear-shaped, the palm gently curved, not defined, bearing a few spines and a dense coating of setæ (like inner margin of carpus); ischium and merus very short, with internal setæ.

Fig. 4.



Carinogammarus annandalei, ♀.

A-B. First and second uropod. C. Telson. D. Third uropod of *C. roeselii* (Gervais). E. Ditto of *C. caspius* (Pallas).

Gnathopod 2. Closely resembling Gnathopod 1, but more elongated, carpus longer, not cup-shaped, propodus elongated-oval.

Peræopod 1. Slightly longer than peræopod 2.

Peræopod 3. Shorter than 4-5; breadth of 2nd joint once and a half in its length; posterior margin feebly emarginate, the joint slightly narrowed distally.

Peræopod 4. 2nd joint longer, more narrowed distally, without posterior emargination.

Peræopod 5. 2nd joint longer, hind margin conspicuously convex, serrated (as in peræopods 3-4), having, besides the marginal setæ, a row of submarginal ones.

Uropod 1. Rami subequal with lateral and apical spines.

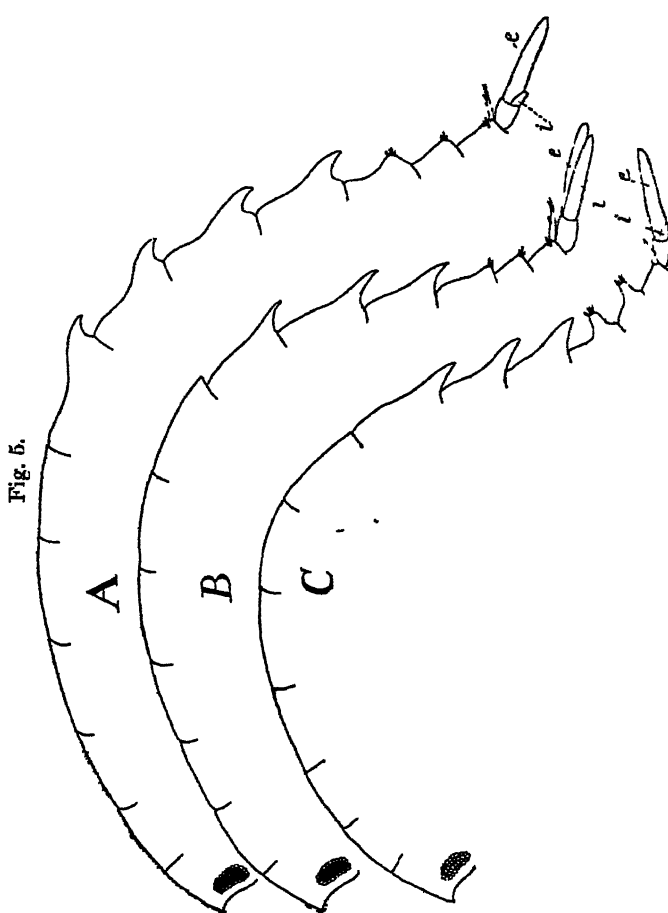


Fig. 5.

Dorsal outlines of *C. annandalei* (A), *C. roeselii* (B), and *C. caspius* (C), showing the distinctive characters of the three species. The right third uropod is represented for comparison of the inner ramus (i).

Uropod 2. Inner ramus conspicuously shorter than outer, with lateral and apical spines.

Uropod 3. Reaching beyond the others; peduncle short; outer ramus 2-jointed (2nd joint extremely short), thrice as long as peduncle in ♂, twice only in ♀, with a few spines (lateral and apical) and setæ (not feathered); inner ramus

minute, scale-like, about half as long as peduncle, with a few spines and setæ.

Types. British Museum (N.H.), No. 1924. 6. 10. 1-4.

Remarks. The presence in the Norman collection of the two related species enables me to point out their distinguishing characters. Following features seem to me worthy of attention (besides, of course, the localities, *Carinogammarus roeselii* and *C. annandalei* being fresh-water forms, respectively from Europe and North Africa, while *C. caspius* is a salt-water form, from the Caspian Sea):—

1. *The size.* My fully adult specimens reach between 7 and 9 mm., when both *C. roeselii* and *C. caspius* are much larger (13-14 mm.).

2. *The accessory flagellum of antennula.* 3-jointed in *C. annandalei*, 3-4-jointed in *C. roeselii*, 4-6-jointed in *C. caspius*.

3. *The eyes.* Black in *C. roeselii* and *C. annandalei*, colourless in all the specimens of *C. caspius* I have seen. (However, they may sometimes be dark in *C. caspius*, *vide* Stebbing, 'Tierreich,' Gammaridea, p. 504.)

4. *The last thoracic segment* has a real tooth in *C. annandalei* (thus having four dorsal teeth) and only a mere projection in *C. roeselii* and *C. caspius* (thus having only three dorsal teeth).

5. *The dorsal teeth* are, in *C. annandalei* and *C. caspius*, more carinated, longitudinally broadened, and more narrow in *C. roeselii*.

6. *The outer ramus of uropod 3* has:—

(a) In *C. roeselii* a conspicuous second joint, and spines and setæ (these feathered on the inner margin only).

(b) In *C. caspius* an obsolete second joint, a few spines and numerous long feathered setæ on both margins.

(c) In *C. annandalei* an obsolete, extremely minute second joint, and spines and setæ (none of these feathered).

7. *The inner ramus of uropod 3* is subequal to the outer one in *C. roeselii*, reduced and scale-like in both *C. caspius* and *C. annandalei*.

XXV.—*Papers on Oriental Carabidæ*.—XIII.

By H. E. ANDREWES.

Genus *LEBIDIA*.

Bull. Acad. Petr. v. 1863, p. 322; id. Beitrag zur Käterfauna der Insel Yesso, 1863, p. 27; Chaud. Bull. Mosc. 1872, ii. p. 417.

This genus is allied to *Lebia*, but the middle of the prothorax is not produced behind, the intermediate tibiæ (δ) are not emarginate on the inner side at apex, and the elytra are more rounded than truncate at extremity. Chaudoir's American genus *Gallerucidia* (Bull. Mosc. 1872, ii. p. 417) is very close to it and differs chiefly in the glabrous fourth joint of the antennæ. The upper surface is minutely punctulate, and there is, in addition, a rather faint microsculpture, isodiametric on head and elytra, transverse and very faint on prothorax. This is less evident, and the puncturation is also finer on the specimens from Japan and the Amur, so that they have a rather smoother appearance. The underside is smooth, sometimes slightly pubescent in middle of venter at base. The ventral segments have two setæ on each side in *8-guttata*, one only in all the others. The apical segment (δ ♀) in *8-guttata* has five or six setæ on each side. Morawitz tells us that in *bioculata* there are four on each side, and this is also true of *pupillata*; in the others there are three only, though the solitary example of *amurensis* has three on one side and four on the other. This apical segment has additional minute setæ at the sides. Morawitz says that the apex of the ligula is bisetose, but its upper margin is also setulose, as is the margin of the paraglossæ. The sides of the prothorax have a single seta, placed on the hind angle.

Hitherto the only species known are the two Japanese ones described by Morawitz, one of which (*8-guttata*) has also been recorded by Fairmaire, though with some doubt, from Moupin, near the eastern frontier of Tibet. I am now describing a new species taken by Mr. H. Stevens in Sikkim and several other forms, which, while agreeing structurally with *bioculata*, differ so much in the elytral markings that I feel obliged to treat them as colour-varieties and give them names. One of these is the variety found by Mr. George Lewis in Japan, and referred to by Bates, as mentioned below. A second comes from the Amur region. A third has recently been taken by Mr. H. G. Champion in Kumaon. Yet a

fourth is represented by three Malay specimens in my collection; these agree with Dr. Jordan's description of his *Sarothrocrepis bimaculata* from Sumbawa, the type of which was taken by Doherty, as were two of my examples from the same locality. Dr. Jordan does not mention the faintly lighter area surrounding the black elytral spots, but, though clearly visible when looked for, it is not at all conspicuous.

CATALOGUE.

amurensis, var. nov. of *bioculata*.

This unique specimen (♂) is labelled "Amur, Reitter." It is in my collection, and was among some insects purchased from Reitter.

bimaculata (*Sarothrocrepis*), Jord. Nov. Zool. i. 1894, p. 106; Andr. Trans. Ent. Soc. Lond. 1921, p. 150. Var. of *bioculata*.

The type, now in Mr. René Oberthür's collection, came from Sumbawa. Two of my examples are labelled "B. Aroe Hassa, Sumbawa, 2-5000'," and a third one "Poera, Ins. Allor, 3-4000'." All the specimens were taken by W. Doherty.

bioculata, Moraw. Beitrag zur Käferfauna der Insel Yesso, 1863, p. 29.

JAPAN: Kumangataki. The type is, I believe, in Petrograd.

himalayica, var. nov. of *bioculata*.

KUMAON: West Almora, West Bhatkot, 4000 feet, Upper Gumti Valley, Nainital, and Ranikhet, on *Quercus incana* (all *H. G. Champion*), 5 ex. BURMA: Karen Mountains (*W. Doherty*), 1 ex. The type is in the British Museum.

octocelis, sp. n.

SIKKIM: Gopaldhara (*H. Stevens*), 1 ex. in my collection.

octoguttata, Moraw. Bull. Acad. Petr. v. 1863, p. 323; id. Beitrag zur Käferfauna der Insel Yesso, 1863, p. 28; Bates, Trans. Ent. Soc. Lond. 1873, p. 318; Fairm. Ann. Soc. Ent. Fr. 1889, p. 6.

JAPAN: Hakodate, Kumangataki, Nagasaki, Hiogo, Yokohama. The type is probably in Petrograd.

pupillata, var. nov. of *bioculata*.

bioculata, Bates, Trans. Ent. Soc. Lond. 1873, p. 318; id. *ibid.* 1876, t. i. fig. 7.

JAPAN: on Maiyasan, near Hiogo. Type in the British Museum.

Key to the Species.

- 1 (4). Elytra with four spots on each elytron.
Length 10.0-12.5 mm.
- 2 (3). Elytra with white spots, a rather larger one at about middle near margin, the other three smaller and arranged more or less transversely at a fourth from apex. *octoguttata*, Moraw.
- 3 (2). Elytra with small black spots, two equidistant from and close to base, the other two arranged obliquely towards margin at apical fourth *octocelis*, sp. n.
- 4 (1). Elytra each with a single large white, yellow-white, or testaceous spot behind middle, extending nearly from suture to margin. Length 8.5-9.0 mm.
- 5 (8). Elytral spot yellow-white, hardly longer than wide, with irregular front and hind margins, surrounded by a fuscous area.
- 6 (7). Elytral spot uniformly coloured *bioculata*, Moraw.
- 7 (6). Elytral spot with a small black roundish central area, the diameter of which is not more than a fifth of the elytron at widest [*lata*, nov.
bioculata, var. *pupil-*
- 8 (5). Elytral spot white or testaceous, quite half as long again as wide, dark at centre, but not surrounded by any fuscous area.
- 9 (10). Elytral spot elongate-oval, a slight indentation behind near suture, the front margin very jagged, central area dirty grey, very large, oval, much more than half the width of elytron at widest [*ensis*, nov.
bioculata, var. *amur-*
- 10 (9). Elytral spot more or less triangular, rounded outwardly behind and with a rather deep indentation near suture, whence the curved inner edge follows a very vague oblique line forward towards outer margin, the central area black, nearly round, about half the width of elytron at widest.
- 11 (12). Elytral spot white [*layica*, nov.
bioculata, var. *hima-*
- 12 (11). Elytral spot testaceous, just visible round the black central area, but only faintly lighter than the ground-colour of elytra. [*maculata*, Jord.
bioculata, var. *bi-*

Lebidia octocelis, sp. n.

Length 10·0 mm. ; width 5·0 mm.

Testaceous, moderately shiny ; joints 5 to 11 of antennæ and tarsi brown ; four small, black, round spots on each elytron black. The four basal spots are on the same level and are placed in a transverse line just behind base ; of the hind pair on each elytron, at about a fourth from apex, the outer spot is close to margin, the inner one obliquely behind it and a little nearer margin than suture. The surface surrounding the spots, especially hind ones, is faintly lighter than the ground-colour.

Head nearly smooth, with very large prominent eyes ; foveæ small and shallow, a slight arcuate groove (convex backwards) between them, and a second similar rather deeper groove in front of vertex. *Prothorax* moderately convex, half as wide again as head and as much wider than long, strongly contracted in front but very little behind, base truncate, very faintly produced at middle, apex emarginate, front angles strongly rounded, sides gently rounded, faintly bordered and reflexed in front, explanate, much more widely behind, where the surface in front of hind angles is slightly raised, hind angles obtuse, distinct but moderately rounded ; median line faint, transverse impressions well-marked, front one deep at middle, foveæ moderately deep, surface smooth, faintly transversely strigose. *Elytra* convex, not quite twice as wide as prothorax and less than half as long again as wide, very slightly dilated behind middle ; no regular striation, though there are traces of a sutural stria, and three rather widely separated subcrenulate striae ; no special pores, those of the marginal series rather small and more widely spaced at middle ; surface smooth, but finely rugose under magnification. Ventral segments with a single seta on each side of median line, last one with three on each side.

Of the same size and shape as *L. octoguttata*, Moraw., but a little darker ; prothorax wider, with more rounded hind angles, elytra less finely punctate and with a totally different pattern, ventral segments with fewer setæ.

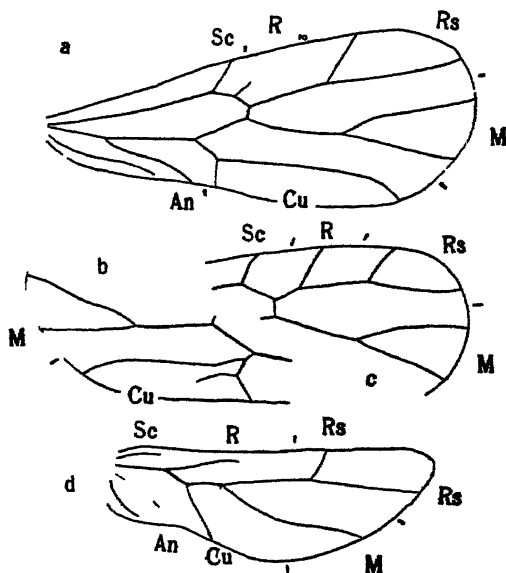
SIKKIM : Gopaldhara (*H. Stevens*), 1 ex., ♀.

XXVI.—On a new *Empheriid* from Uganda (*Copeognatha*).

By H. H. KARNY, Buitenzorg, Dutch East Indies.

Psylloneura ugandana, sp. n.

Body brownish yellow. Membrane of wings hyaline, colourless, densely pubescent, with pale greyish eyes. Eyes moderately large, black. Ocelli large, with red pigment cups, almost touching each other, situated mesad on a line drawn through the fore margin of eyes. Antennæ broken off after the second joint. Maxillary palpi as in *P. simbangana*. Tarsi 3-jointed, metatarsus about equal in length

Venation of *Psylloneura ugandana*, sp. n.

a, fore wing; *b*, *c*, part of anomalous fore wings, *d*, hind wing.
Sc, subcosta; *R*, radius; *Rs*, radial sector; *M*, media; *Cu*, cubitus;
An, anal vein.

to 2+3, in fore legs a very little shorter, in hind legs a very little longer.

Arrangement of veins practically as in *P. simbangana*, shape of wings more resembling *Tapinella*. Both pairs with their whole surface closely set with very short hairs; veins and margins without stronger hairs.

Fore wings (text-fig., *a-c*): *Sc* short; *R* arising somewhat

distad from *Sc*, in three of the wings before me distinctly before the cross-vein connecting *Rs* and *M*; in one of the wings (text-fig., c) distad from this cross-vein (in the same manner as in the left fore wing of *P. simbangana*, described and figured by Enderlein). In one of the wings, *R* very short and evanescent (text-fig., a), in the three others reaching the front margin, *Rs* bifurcate ($R_{2+3} + R_{4+5}$, according to Enderlein's nomenclature); its fore branch much shorter than the second. Media bifurcate, fore branch a little longer than second, fork narrower than in *simbangana*; second branch about as long as the fork-shaft, and distinctly longer than the marginal distance of M_1 and M_2 . Cubital vein forked, Cu_1 very long, fork-shaft and Cu_2 short, about equal in length. First cubital cell ("areola postica") therefore very long. In one of the fore wings before me (text-fig., b) there arises after Cu_1 a second short branch from Cu_2 , not reaching the hind margin. Anal vein united basad with $M + Cu$. Axillary vein reaching the hind margin distinctly before *An*.

Hind wings (text-fig., d): *Sc* restricted to base, somewhat indistinct. *R* arising before *Cu*, not reaching fore margin; an indistinct oblique cross-vein between *R* and $Rs + M$, *Rs* bifurcate; R_{2+3} short, reaching the margin far before apex, R_{4+5} behind apex. Medial and cubital vein simple. Hind margin of wings not produced at the end of *Cu*, as it is in *simbangana*. Anal vein hyaline, very indistinct.

Length of body 1.6–1.7 mm., of fore wings 1.1–1.4 mm.

Two specimens collected by Mr. H. Hargreaves, at Kampala, Uganda (6. i. 1921; G. 255), on flower of "Karandalujo," together with two species of Thysanoptera, viz., *Frankliniella dampfi*, Priesner, and *Thrips kikuyuensis*, Trybom. I received this material from the Imperial Bureau of Entomology for determination.

This new species belongs to the Empheriidae, differing from Psyllopsocinae by its densely pubescent wings and the distant *An* and *Ax*. The bifurcate *M* of fore wings places it to the Tapinellinae. From *Rhyopsocus* and *Tapinella* it differs by the bare veins and wing-margins, and by the situation of *R* in the hind wings. By these characters, it comes to *Psylloneura*, where it may be distinguished from the New Guinean *P. simbangana*, by the pale colour of the body, and by the colourless narrower wings. In the shape of the wings it agrees better with *Tapinella* than with *Psylloneura simbangana*. It cannot be mistaken for *Tapinella formosana*, differing from it, apart from the generic characters, in the medial fork of the fore wings, which is distinctly broader in *T. formosana*.

XXVII.—*New Species of Phytophaga (Coleopt.)*. By G. E. BRYANT, Entomological Assistant, Imperial Bureau of Entomology.

Family *Clytridæ*.

Camptolenes bifasciata, sp. n.

♂. Elongate, gradually narrowed behind, testaceous, with the head, part of the prothorax, and two fasciæ on the elytra cyaneous; the underside with the meso- and metasternum and the ventral segments cyaneous, with short pubescence. L. 8 mm.

Head cyaneous, rugosely punctured, more so in front, transversely depressed between the eyes; the mandibles testaceous with the apex darker, stout and strongly curved. Antennæ stout, extending nearly to the base of the prothorax, black with the three basal joints testaceous. Prothorax transverse, a little broader than the base of the elytra, with the sides rounded, testaceous, with two cyaneous patches connected together at the base by an inverted V-shaped patch, rugosely punctured. Scutellum blue, triangular, punctate. Elytra about two and a half times as long as the prothorax, gradually narrowed to apex, feebly punctured, testaceous with two blue fasciæ, the basal one not touching the lateral margin or the suture, and curved upwards at the shoulder, the apical fascia placed behind middle, broader and extending across the suture, but not touching the lateral margin. Prothorax testaceous, the meso- and metasternum and ventral segments cyaneous, with short pubescence. The front legs long, with the tibiæ blue and strongly curved, the femora with the basal half testaceous, bluntly toothed in the middle; the middle and hind legs entirely blue and shorter than the front pair.

♀ unknown.

TRANSVAAL: 2 ♂♂, Pretoria, 4. v. 1917.

Forwarded by the Division of Entomology, Pretoria. Allied to *C. fastuosa*, Jac.

Family *Eumolpidæ*.

Typophorus jamaicensis, sp. n.

♂. Rufous; the antennæ, head, prothorax, and scutellum rufous; elytra violaceous, finely punctate-striate, the punctures feebler towards the apex. L. 7–8 mm.

Head rufous, very finely punctured, almost glabrous; labrum black, impressed between the eyes. Antennæ rufous, with very short pale pubescence, extending nearly to the middle of the elytra; the first joint longer and more swollen than the second, the third joint about equal to the first, the third to the terminal joints about equal to each other. Scutellum subtriangular, impunctate, rufous. Prothorax rufous, with very fine scattered punctures, almost glabrous, transverse, widest just before the base, gradually narrowed to the apex. Elytra violaceous, widest behind the middle, shoulders well marked, feebly depressed below the base, rather strongly punctate-striate, the punctures less well marked towards the apex. Underside and legs rufous; all the femora toothed, the hind pair more strongly so than the front and middle.

♀. Of broader and stouter build.

JAMAICA: 2 ♂♂, 2 ♀♀, Brit. Mus. Coll.; 1 ♀, Cinchona, 22. vii. 1923 (*C. C. Gowdey*).

This species may be distinguished from all its allies having a rufous prothorax and blue or violet elytra by its broader build, especially the ♀, and its more violaceous colour.

Allied to *T. erythrocephalus*, Jac.

Nodina chinensis, sp. n.

Oval, colour above metallic green or æneous, the underside black; the four basal joints of the antennæ, mouth-parts, and legs fulvous. Head and the prothorax finely punctured, the elytra more strongly punctate-striate. L. 2-2.50 mm.

♂. Head smooth, but finely punctured, the labrum and mouth-parts fulvous. Antennæ extending a little beyond the base of the prothorax, with the four basal joints fulvous; the two basal joints longer and more swollen than the third and fourth, the seven apical joints piceous, and all shorter than the third and fourth. Prothorax twice as broad as long, finely punctured; the side margined, almost straight, from the middle to the base, and the anterior portion much deflexed; the basal margin broadly produced at the middle, with a distinct line of punctures extending along the base. Elytra with regular rows of rather stronger punctures, a little broader at the base than the prothorax, rounded to the apex, and strongly margined, the humeral angle very prominent and impunctate. Underside black, with the ventral segments about equal, clothed with slight greyish

pubescence. Legs fulvous, with the first joint of the front tarsi distinctly dilated.

♀. Differs in the elytra having a distinct costa. The humerus is more developed, almost costate, and is connected with a strong costa which runs obliquely towards the middle of the lateral margin. The first joint of the front tarsi is not dilated.

CHINA: 84 ♂♂, 72 ♀♀, Foochow, Fukien Prov., 1922 (*S. F. Light*).

Allied to *N. brevicostata*, Jac., from Sumatra, but easily distinguished by its larger size, the fulvous femora, and the form of the elytral costa in the female.

Family Halticidæ.

Phyllotreta capicola, sp. n.

Oblong-ovate, very depressed; black, shining, with the base of the antennæ and the tibiæ reddish, and each elytron with a longitudinal yellow stripe. L. 1.50 mm.

Head black, shining, impunctate, with a short longitudinal impression between the eyes; the mouth-parts black. Antennæ extending to about the middle of the elytra, black with the three or four basal joints reddish; the first joint long and equal to the second and third combined. Prothorax black, subquadrate, finely punctured, sides very slightly rounded. Scutellum black, shining, impunctate. Elytra black, finely punctured, with a broad yellow longitudinal stripe on each elytron, the stripes having their inner margins straight and parallel to each other, but slightly incurved at the apex. Underside black; legs black with the base of tibiæ and tarsi reddish. The first ventral segment large, 2nd, 3rd, and 4th about equal to each other, 5th longer than the 4th and slightly notched in the ♂.

SOUTH AFRICA: Herschel, Cape Province, 22. iv. 1922. Forwarded by the Division of Entomology, Pretoria, with the information that the beetles are destructive to cabbage.

This is a very small species, and as regards pattern is allied to *P. weisei*, Jac., among the African species. Its nearest ally appears to me to be *P. turcomenica*, Wse., from Asia Minor.

Longitarsus cyanipennis, sp. n.

Ovate, above metallic blue, the underside black; antennæ

in the ♂ as long as the body, black with the three basal joints rufous; prothorax broader than long, finely punctured, with a greenish tinge; elytra metallic blue, more strongly punctured than the prothorax. Legs black. L. 3 mm.

♂. Head impunctate, black and shining. Antennæ black, extending to the apex of the elytra, the three basal joints rufous; the first joint about as long as the second and third together, the fourth to the terminal joints black, elongate, and about equal to each other. Prothorax broader than long, of a greenish metallic blue, the sides feebly rounded at the middle, the anterior angles oblique, the surface finely punctured. Scutellum triangular, impunctate. Elytra slightly broadened at the middle, metallic blue, more strongly punctured than the prothorax. Legs blackish, the femora slightly darker than the tibiæ and tarsi, with the apex tinged with rufous; the front tarsi with the first joint elongate, and much broader than the second in the ♂, and the hind tarsi with the first joint nearly as long as half the length of the tibiæ. Underside black.

♀. The antennæ are shorter, and the first joint of the front tarsi is not much broader than the second.

INDIA: 2 ♂♂, 1 ♀, Lahaul, Punjab, 19. viii. 22 (O. H. Walters).

Of about the size and structure of *L. rufipennis*, Jac., from Madura, but the colour and punctuation are entirely different.

Disonycha gowdeyi, sp. n.

Oblong-ovate, slightly convex; head and prothorax fulvous, head with three dark spots, prothorax with seven; elytra glabrous, deep purplish brown with two fulvous vittæ, and the lateral margin fulvous with the epipleuræ purplish; underside fulvous. L. 6-7 mm.

Head impunctate, fulvous, labrum black, two dark spots placed just behind the insertion of the antennæ, almost touching each other, a larger dark spot at the base touching the anterior margin of the prothorax. Antennæ black, with short pale pubescence, with the three basal joints fulvous and tinged with piceous; extending to about the middle of the elytra, the first joint not quite so long as the second and third together, and more swollen, the third a little longer than the fourth, the fourth to the terminal about equal to each other. Prothorax fulvous, impunctate, transverse, with the sides almost parallel; the anterior angles rounded, and

the basal angles oblique; there are seven dark spots arranged in two rows, four in front and three behind. Scutellum triangular, purplish brown, impunctate. Elytra a little broader than the base of the prothorax, the sides almost parallel but rounded to apex; dark purplish brown, with two fulvous vittæ and the lateral margin fulvous, impunctate. Underside fulvous, the ventral segments with short pale pubescence. Legs fulvous, with the apical third of all the femora fuscous; posterior femora strongly incrassate; the tibiæ with a fulvous band near base, the remainder fulvous; tarsi fuscous.

JAMAICA: Runaway Bay, 10. iv. 1905 (*Lord Walsingham*); Hill Gardens, 6 vii. 1923 (*C. C. Gowdey*).

A very distinct species, on account of the well-marked prothorax, which is constant in the seven specimens before me.

Allied to *D. quadrivittata*, Illig., from S. America.

Family Galerucidæ.

Diabrotica jamaicensis, sp. n.

Subelongate, flavous, with the head, scutellum, and metasternum black; the elytra olive-green, with a curved black vitta not extending to the apex; legs with the femora flavous, the tibiæ and tarsi black. L. 6 mm.

Head not longer than broad, black, shining; a fovea between the eyes. Antennæ blackish, with the three basal and the ninth and tenth joints pale greenish; filiform, the first joint longer than the second and third combined, the fourth equal to the first. Prothorax about as broad as long, fulvous, glabrous, the sides slightly sinuate, the anterior angles truncate. Scutellum black, impunctate, triangular. Elytra very finely punctured, pale olive-green, with a black vitta on each extending from the shoulder, and slightly curved inwards to the middle, thence broadening out, the inner margin nearly parallel with the suture, and the outer margin curving outwards, not reaching the apex or lateral margin. Underside flavous and clothed with scattered pale pubescence; the metasternum black; the first three ventral segments about equal. Legs with the femora flavous, the tibiæ and tarsi black.

JAMAICA: 1 ♀, Hope Gardens, 24. i. 1921; 1 ♂, Cinchona, 4. viii. 1923 (*C. C. Gowdey*).

Described from twenty-five specimens.

Allied to *D. buckleyi*, Baly, from Ecuador, but the elytral pattern entirely different.

Galerucella wolcotti, sp. n.

Elongate, greyish brown, finely and closely pubescent; prothorax testaceous, with a central and two lateral depressions; elytra with four longitudinal greyish stripes, and a feeble greyish stripe between the second and third. L. 4 mm.

Of narrow elongate shape; the head greyish brown, with fine pubescence, with a longitudinal central impression, the clypeus testaceous and strongly transverse. Antennæ not extending to the middle of the elytra; the joints testaceous with the apical portion of each fuscous; the first joint longer than the second, the third about equal to the first, the fourth slightly shorter, the fourth to the terminal about equal to each other. Prothorax testaceous, with fine pubescence, transverse, with the sides rounded a little before the middle, and contracted in front and behind, the anterior angle forming a small tubercle; the surface with a deep depression on each side, and a longitudinal impression in the middle, expanding towards the posterior margin. Scutellum subquadrate, greyish brown, pubescent. Elytra elongate, depressed behind the shoulders, a little broader than the base of the prothorax, rounded at apex; of a greyish-brown colour, with four longitudinal greyish-white stripes—one touching the suture, the second parallel to the suture, but curving outwards at the apex and joining the third, the latter starting at the shoulders, slightly curved inwards at the middle, and then curving and joining the suture near the apex, and the fourth is a less well-defined stripe; in between the second and third stripe there is a thin ill-defined greyish stripe. Underside with the meso- and metasternum, and ventral segments of the abdomen slightly darker and more shining, and less pubescent; ♂ with the fourth and fifth segments each with an impression in the middle near the posterior margin. Legs testaceous, clothed with pubescence, apical half of tarsal joints fuscous.

PORTO RICO: San Juan, 1923; Carolina, 12. vi. 1915 (*G. H. Wolcott*).

Closely allied to *G. varicornis*, Wse., and to *G. ornata*, Jac.

XXVIII.—On the Existence of the Japanese Killifish,
Fundulichthys virescens. By G. S. MYERS.

FOR many years—in fact, since the appearance of the 'Fauna Japonica'—ichthyologists have been puzzled by the existence in Japan of a remarkable killifish, called *Fundulus virescens* by Schlegel*. In the anterior dorsal, posterior anal, complete lateral line and forked caudal fin†, this fish has appeared to differ from all the known genera of Poeciliidae.

The history of this fish is rather unusual. Schlegel, who named it, never saw a specimen, but depended on Bürger's drawing and possibly some notes. As reproduced in the 'Fauna,' the drawing shows no teeth on the jaws, although these are mentioned by Schlegel. In 1860, Bleeker‡, also without having seen the fish, proposed the genus *Fundulichthys* for it. In 1883§, it was recorded from Tokyo and Nagasaki, and in 1897|| from Owari. In their review of the Japanese killifishes, Jordan and Snyder¶ mention that they have never seen the fish, although they recognize it and repeat Schlegel's description.

It has seemed queer that no one has ever definitely described an authentic specimen of the species, and some time ago I began to doubt its validity. However, the discovery that Tanaka, as lately as 1908**, recorded obtaining two specimens at Tokiwa, where the fish was known as "Kinta," somewhat revived my faith in its presence in the Japanese fauna.

With the idea of obtaining information regarding the species, and if possible, a specimen of it, I addressed inquiries to Dr. David Starr Jordan and to Dr. Tanaka. Under the date of February 14, 1924, Dr. Jordan replies: "I have for some time doubted the existence of *Fundulichthys virescens*. I did not find it in a rather thorough scraping of the 'ruisseaux' about Nagasaki. Neither did Yoshiro Wakiya,

* 'Fauna Japonica, Pisces,' 1846, p. 225, pl. cii. fig. 6.

† A forked caudal is possessed by Poeciliids of the subfamilies Lamprichthyinae, Adrianichthyinae, and Phallostethinae. The forked caudal twice figured by Boulenger for his *Haplochilus elegans*, from the Congo, should have been represented as lyre-shaped.

‡ Conspect. Syst. Cyprin. p. 489.

§ Namiye, Class. Cat. p. 107.

|| Ishikawa & Matsura, Prel. Cat. p. 18.

¶ Proc. U.S. Nat. Mus. xxxi. 1906, pp. 287-290.

** Annotat. Zoolog. Japonensis, vii. p. 9.

who made a large collection for me in Kiusiu in 1922. In the brooks and rice-ditches I got plenty of the little 'Medaka,' which I called *Oryzias*." Dr. Tanaka, in a letter dated March 20, says: "Your letter received, and allow me to state that *Fundulichthys virescens* does not exist so far as I am aware. What was described as such is in reality the young of a cyprinoid fish resembling externally a figure found in the 'Fauna Japonica,' named *Fundulichthys virescens*. I am pretty sure the fish is the young of *Pseudorasbora parva*." Dr. Tanaka does not make it quite clear whether it is Schlegel's fish, or his own recorded specimens, or both, that he believes is *Pseudorasbora*. However, this does not make much difference, as he definitely states that he does not believe Schlegel's species exists. As to the resemblance of the head of *Pseudorasbora* to a Pœciliid, I may say that I have examined Chinese specimens of this genus in the American Museum, and find that the head is somewhat Pœciliid-like; but the body is very characteristically Cyprinoid, as is the body in Schlegel's figure of *Fundulichthys*.

Schlegel's definite statement regarding the teeth is hard to explain, but as he never saw the fish, and as the reproduction of Bürger's figure does not show them, I think we may reasonably assume that a mistake was made somewhere. Thus, from all the evidence available, it would seem that the species *Fundulichthys virescens* (Schlegel) must be dropped from the system, and that thereby a most perplexing question in the geographical distribution of the killifishes is closed.

XXIX.—*A new Species of the Drosophilid Genus Gitona (Diptera), bred from Figs in Cyprus.* By Prof. M. BEZZI, Turin, Italy.

IN the recent general work on Drosophilidæ, by A. H. Sturtevant*, three species only are recorded as belonging to the genus *Gitona*, Meigen. But of these species *Gitona ? pruinosa*, Bigot, from Djerba†, is certainly not a member of the genus, being probably a Chloropid. And even

* Carnegie Institution of Washington, 1921, Publication No. 301, p. 54.

† 'Exploration scientifique de la Tunisie,' Zoologie, Diptères, Paris, 1888.

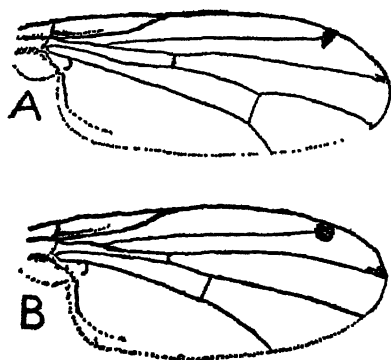
Gitonides perspicax, Knab*, placed here by Sturtevant, seems to be generically distinct, as in typical specimens from Honolulu, received by the late Dr. Fr. Knab, the second basal cell of the wings is separated from the discal cell.

The genus *Gitona* is thus at present monotypic, being restricted to the type-species *distigma*, Meigen, which is not rare in South Europe. The bionomics of this species are almost unknown; the fly has been bred from the flower-heads of the composite plant, *Sonchus arvensis*, and the larvæ are suspected to be aphidiphagous. In middle Italy I have met with the species only on windows in houses.

It is important to know that in the Mediterranean sub-region there is a second species of the genus, recently sent me for determination by Dr. Guy A. K. Marshall. The description is as follows:—

Gitona distans, sp. n., ♀.

Very near *distigma*, but at once distinguished by the much more distant cross-veins of wings.



A. Wing of *Gitona distans*, sp. n.

B. Wing of *Gitona distigma*, Meigen. Greatly enlarged.

♀. Length of body 3 mm., of wing 3.2 mm. Head entirely yellowish, grey-dusted; eyes red, not banded. Frons parallel-sided, subquadrate; dark grey in the middle, with whitish sides and a whitish triangle in front of the ocellar plate; the orbits have 2–3 blackish dots on each side at the insertion of the orbital bristles. Cephalic bristles

* 'Insecutor Inscitiæ Menstruus,' Washington, 1914, ii. p. 165.

black, disposed as in *distigma* *; the setulæ of the ocellar plate and of the anterior part of the frontal stripe are likewise black. Antennæ more broadly separated than in *distigma*; they are entirely yellowish with minutely pubescent arista. Face yellowish, with its broad carina more pale along the middle; peristomialia twice as broad as in *distigma*; palpi and proboscis yellowish.

Mesonotum grey, with numerous minute dark dots as in *distigma*, but with distinct brown stripes, resolved into separate elongate spots; these stripes are approximately five, but only the middle one is continuous. Pleuræ paler, yellowish below, with two narrow brown stripes, one in the middle of mesopleura, the other at upper border of sternopleura. Chætotaxy as in *distigma*; all the bristles black; setulæ of back disposed in more numerous rows. Scutellum of considerably greater size than in *distigma*, quite bare above, with four marginal bristles; it is whitish grey, with three brown stripes on the basal half and a yellowish hind border. Halteres white with yellowish stalk.

Abdomen yellowish, whitish-dusted; the segments from the third to the fifth have a black spot in the middle and a black band on each side; the second segment has only the bands, being destitute of the middle rounded spot. These bands are not in contact with the hind border of the segments, as they are in *distigma*. Venter unspotted, yellowish. Hairs and bristles black.

Legs entirely pale yellowish, with last joints of tarsi blackened; bristles and hairs black.

Wings hyaline, with yellowish veins disposed as in *distigma*; the black spot at end of second vein is smaller and not rounded; the black spot at end of third vein is less developed. The cross-veins are much more distant than in *distigma*; the hind cross-vein (text-fig., A) is about as long as the portion of fifth vein beyond it, while in *distigma* (text-fig., B) the above-named cross-vein is about one-third the length of the distal part of the fifth vein.

Some female specimens from Cyprus, 11th September, 1923, bred from figs (*D. S. Wilkinson*).

Type in British Museum; one paratype in the writer's collection.

* For chætotaxy of *Gitona*, compared with that of *Aoletoreenus*, see Oldenberg, Archiv für Naturgesch. lxxx. 1914, pp. 29-30.

THE ANNALS
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[NINTH SERIES.]

No. 81. SEPTEMBER 1924.

XXX.—*Exotic Muscaridæ (Diptera).*—XIII.* By J. R. MALLOCH, Bureau of Biological Survey, Washington, D.C.

Genus HYDROTÆA, R.-D.

I present a key to the African species of the genus *Hydrotæa* in the hope that it may prove useful in the identification of these insects, the descriptions of which are scattered, and mostly in German.

The genus is essentially one of the Northern Hemisphere, most of its representatives occurring in Europe and North America, there being but few in South America and but two in Australia known to me, besides the six included in the appended key. Most of the known species feed in the larval stages in manure or refuse, but one species I have just recently described is found in the immature stages in nests of birds, though probably a scavenger.

The males of this genus may be distinguished from all others in the family by the presence of a more or less conspicuous concavity on the ventral surface of the fore femur, at the basal extremity of which there are two stout thorns or spines. The females are not so readily distinguished, but they have always four pairs of postsutural dorso-central bristles, almost invariably but two sternopleurals (1:1), the frontal lunule is always silvery, the

* For Part XII., see *Ann. & Mag. Nat. Hist.* (9) xiii., April 1924, pp. 409-424.

interfrontalia ~~has~~ a pair of cruciate bristles, the lower supraorbital bristle is proclinate, the lower calyptra is larger than the upper, and very frequently the halteres are black or dark brown. The genus belongs to the subfamily Phaoniinæ.

Key to African Species (Males).

1. Eyes densely long-haired; hind tibia with a complete series of short erect hairs on antero-dorsal surface 2.
 Eyes bare or very sparsely haired, if with evident hairs there is no complete series of erect hairs on antero-dorsal surface of hind tibiæ 3.
2. Thorax black-brown, subopaque; abdomen black-brown, brownish-dusted, with a faint black dorso-central vitta *fumifera*, Walker.
 Thorax grey-pruinose, with three large pre-sutural black spots which are fused anteriorly, the lateral spots short, the median one extending to suture, and a broad post-sutural black fascia which is indented on hind margin; scutellum black; abdomen almost silvery pruinose, with a broad dorsal vitta and a broad fore marginal band on segments 2 to 4 black *fasciata*, Stein.
3. Hind femur noticeably curved, and distinctly swollen on underside near apex 5.
 Hind femur normal, neither distinctly curved nor swollen near apex 4.
4. Antero-dorsal surface of hind tibia with a complete series of fine erect hairs on its entire length which are about as long as the diameter of tibia, three or four similar hairs at middle on postero-ventral surface of same tibia; thorax shining black, with faint dusting and not distinctly marked; abdomen silvery-grey pruinose, first visible tergite and a central vitta on the others black *nigribasis*, Stein.
 Antero-dorsal surface of hind tibia without a series of erect fine hairs; thorax whitish-grey pruinose, with two short narrow streaks on fore margin and a round spot on each side in front of suture, as well as a broad postsutural fascia and the scutellum opaque black; abdomen grey-pruinose, with a black vitta which tapers posteriorly, and a pair of black spots on fourth tergite; eyes sparsely hairy *maculithorax*, Stein.
5. Calyptræ whitish; swollen part of hind femur with four or five bristles on antero-ventral and postero-ventral surfaces; mid-femur without blunt-tipped bristles on postero-ventral surface *longipila*, Stein.
 Calyptræ fuscous; swollen apical part of

hind femur with a large number of fine
 hair-like bristles on all ventral surfaces;
 mid-femur with about six long blunt-
 tipped bristles near middle on postero-
 ventral surface *femorata*, Stein.

Hydrotæa femorata, Stein.

The mid-femur has about half-a-dozen blunt-tipped bristles, which remind one of those present in the male of *occulta*, Meigen. There is a short bristle present on the middle of the postero-ventral surface of hind femur, and on the same femur there is a series of long bristles about six in number on the anterior surface of the apical third. Stein cites the presence of a mid-tibial ventral bristle and distinct presutural acrostichal bristles as characters for the separation of *longipila*, Stein, from *femorata*. In the specimens before me, however, there is no distinction in this respect, both males of *femorata* having a distinct ventral bristle near apex on mid-tibia.

Two males and one female, Ulundi, Natal, 5000-6500 feet, ix. 1896 (*G. A. K. Marshall*).

Hydrotæa nigribasis, Stein.

A small species, about 3 mm. in length. Only the antero-ventral bristles on hind tibia strong, all the others fine and hair-like.

Two males, Estcourt, Natal, ix.-x. 1896 (*G. A. K. Marshall*).

Genus *EMMESOMYIA*, Malloch.

I present a key for the separation of the African species of this genus known to me, in the hope that it may enable other workers to identify the species, many more of which probably occur on this continent.

The genus belongs to the subfamily Anthomyiinae, distinguished by the complete sixth wing-vein, presence of fine soft hairs on the lower surface of the scutellum, and of a bristle at the base of the hind metatarsus below. No species has more than three pairs of postsutural dorso-central bristles, and all of the species known to me have the lower calyptra distinctly protruded beyond the apex of the upper. These characters, as a whole, apply to many species of *Pegomyia*, R.-D., but in *Emmesomyia* there is an outstanding bristle on the upper margin of the pteropleura just below the base of the wing, which is absent in the former. In *Tanomyia*, Stein, this bristle is replaced by a number of stiff hairs. *Emmesomyia* is represented in North America, but I have not yet seen any species from Europe.

Key to Species.

1. Thorax with more or less noticeable dark dorsal vittæ, not fasciate behind suture . . 2.
 Thorax with two or more black spots in front of suture and three subcontiguous spots or a complete broad black fascia just behind suture 3.
2. Hind tibia with three antero-dorsal bristles. *tarda*, Stein.
 Hind tibia with two antero-dorsal bristles. . *africana*, Malloch.
3. Legs yellow, apices of all femora narrowly black, tarsi brown *nigrolutea*, Malloch.
 Femora more extensively infuscated, usually entirely so, or only basally yellowish 4.
4. The black central spot on second and third tergites broadened anteriorly, subtriangular; scutellum almost entirely brownish fuscous; tibiæ tawny yellow *natalia*, sp. n.
 The black central spots mentioned above slightly widened posteriorly; apex of the scutellum with a distinct pale grey spot; tibiæ fuscous, pale at bases *maculithorax*, Stein.

N.B.—The following species may be referable to *Emmesomyia*:—*fascigera*, Stein, *ignobilis*, Stein, *singularis*, Stein, and *virgithorax*, Stein. The last two, however, Stein says have the lower calyptra small and may really belong to *Hylemyia*, in which genus he described them. The others he placed in *Tenomyia*, Stein.

Emmesomyia natalia, sp. n.

Male.—Black, densely covered with pale grey pruinescence. Head black, orbits, face, and cheeks silvery grey. Dorsum of thorax in front of suture when seen from behind with a black spot laterad of each series of dorso-centrals, which is connected anteriorly with another at the anterior dorso-central; the broad black postsutural fascia rather widely interrupted by a stripe of brownish-grey pruinescence along the dorso-centrals; scutellum almost entirely black, brownish grey only on margins; pleura unspotted. Abdomen with a black spot on each tergite from first to fourth visible, all of which are widened anteriorly, those on second and third most conspicuously so, the disc of segments brown along sides of the spots; hypopygium grey-pruinescent. Legs black, trochanters, extreme bases of femora, and all of tibia tawny-yellow. Wings hyaline. Calyptræ white. Halteres yellow.

Frons linear above, each orbit with about five long setulæ anteriorly; arista with short pubescence; parafacial linear;

cheek as high as width of third antennal segment. Pre-sutural acrostichals in three pairs, widened anteriorly, and with shorter interspersed hairs; prealar short; disc of scutellum haired; sterno-pleurals 1:2. Abdomen short and rather broad, depressed, fifth sternite fringed with black hairs along inner sides of processes. Legs as in *africana*, but the hind tibia with three or four short antero-dorsal bristles. Costal thorn short; outer cross-vein curved, at little more than its own length from inner. Lower calyptra much larger than upper.

Length 5 mm.

Type, Estcourt, Natal, ix.-x. 1896 (*G. A. K. Marshall*).

Emmesomyia maculithorax (Stein).

One male from Njoro, B.E.A., 16.i. 1912 (*T. J. Anderson*). Originally described as a species of *Hydrophoria*.

Genus HYLEMYIA, R.-D.

The genus *Hylemyia* belongs to the subfamily Anthomyiinae, and has been variously limited by different authors. The genera *Phorbia*, R.-D., and *Chortophila*, Macquart, are not valid genera but segregates of *Hylemyia* which are not so clearly limited by any characters that they can be considered as entitled to subgeneric rank, and in all my recent papers I have treated species which might possibly be referred to either as merely species of the large genus *Hylemyia*.

As limited here the genus is distinguished from *Pegomyia* by the presence of more than two postero-dorsal bristles on the hind tibia; and from other genera by the lower calyptra not being larger than the upper, the pleura with only the usual hairs and bristles, there being no hairs on pteropleura, propleura, nor hypopleura, nor on the prosternum. The mid-tibia lacks a ventral bristle, and in all the species in this key the eyes of the males are almost contiguous at middle of frons.

I present a key for the identification of the African species which I have seen or which are so described that it is possible to include them. The genus is poorly represented in Africa and Australia, the greatest number of its representatives being found in the Northern Hemisphere, as is the case with *Hydrotæa*. Some of the species are of economic importance, feeding in the larval stage on sprouting seeds or root-crops such as radishes, onions, &c. The cosmopolitan species *cilicrura*, Rondani, which occurs

in Africa, is known in North America as the corn-root maggot, but it attacks beans and other sprouting seeds. At least two species of the genus feed in young wheat.

Key to Species (Males).

1. Base of wing with a conspicuous black band; mid-metatarsus with some long setulose hairs on dorsal surface which are longer than the diameter of the segment *metatarsata*, Stein.
- Base of wing without a conspicuous black band; mid-metatarsus without long hairs on dorsal surface..... 2.
2. Both cross-veins of wings very conspicuously clouded with brownish fuscous; abdomen with three series of dark spots, one in centre of dorsum and the others on each side just at the curves of the tergites, the latter rather inconspicuous *sinensis*, Jaenn.
- Cross-veins not noticeably infuscated; abdomen with a median dark vitta, but no lateral dark spots 3.
3. Fore tibia with a blunt-tipped spine at apex on anterior side; hind tibia with a complete close-set series of fine erect hairs on the postero-ventral surface *cilicrura*, Rondani.
- Fore tibia without a stout blunt-tipped spine at apex on anterior side, with or without a short sharp bristle at this place; hind tibia without a complete series of hairs as above 4.
4. Thorax with three broad conspicuous black or dark brown vittæ 5.
- Thorax with at most very inconspicuous dark vittæ 6.
5. Median vitta of thoracic dorsum continued very distinctly to apex of scutellum, the vittæ fuscous-brown; third ventral abdominal segment with dense long downwardly-directed bristles; prealar bristle very short; tibial bristles short *ventralis*, Stein.
- Median vitta of thoracic dorsum not extending to apex of scutellum, the vittæ deep black; third abdominal sternite without conspicuous bristles; prealar and tibial bristles very long and strong..... *vittithorax*, Stein.
6. Hind femur with about three bristles on apical third of antero-ventral surface, none of which are longer than the femoral diameter, the postero-ventral surface bare except for a short preapical bristle; processes of fifth sternite broad, rounded at apices on inner side and angulate on outer, with a few setulose hairs on outer apical angles *andersoni*, sp. n.
- Hind femur with more numerous bristles

- which begin nearer base and some of which are very noticeably longer than the femoral diameter; postero-ventral surface with numerous bristles or hairs before middle; processes of fifth sternite narrow 7.
7. Hind femur with about six antero-ventral bristles which are rather stout and not hair-like at tips; tibiæ yellowish basally, those of female entirely tawny-yellow; cheek about one-fourth of the eye-height. *flavibasis*, Stein.
- Hind femur with about twelve long antero-ventral bristles which are hair-like and slightly curled at tips; tibiæ black; cheek about one-fourth of the eye-height *capensis*, sp. n.
- Hind femur with a complete series of fairly long bristles on antero-ventral surface; tibiæ black; cheek from one-tenth to one-eighth of the eye-height..... *modesta*, Stein.

Hylemyia sinensis, Jaenn.

This species might possibly be placed in the genus *Hydrophoria* because of the cylindrical abdomen and the peculiar finger-like processes of the fifth sternite. It rather resembles *Hylemyia variata*, Fallén, but the infuscated cross-veins and the conspicuously vittate thoracic dorsum are very characteristic. The tibiæ are usually reddish basally.

Four males and one female, Willow Grange, Natal (*R. C. Wroughton*).

Hylemyia sinensis, var. *intensa*, nov.

Male.—Differs from the type-form in having the cloud on the cross-veins larger, that on the outer one much enlarged at the upper extremity of the vein, and a brown spot at base of discal cell on fourth vein which crosses the cell in front of that vein. This last spot is not present in any of the other specimens before me, though they have the junction of third and second veins noticeably darker than the other parts of the veins, which is also the case in the variety. The central dark spots on the dorsum of the abdomen in the variety are larger than in the type-form, forming a complete vitta. Possibly a distinct species, but represented by but one damaged specimen.

Length 5 mm.

Type, Kijabe, Kikuyu Escarp., Kenya Colony, 7000–8000 feet, bamboo forest (*W. J. Radford*).

Hylemyia cilicrura, Rondani.

Specimens from Mashonaland, Natal, and Kenya Colony.

Hylemyia ventralis, Stein.

An easily identified species with its very conspicuously vittate thorax and the outstanding bristles on the third ventral segment of the abdomen in the male. Stein, who described the species in *Chortophila*, stated that these bristles are on the second sternite, omitting the rudimentary first in his count.

Three males, W. of Mt. Kenya, 6500–7250 feet; and one male and one female, N. of Mt. Kenya, 8300 feet (*T. J. Anderson*).

Hylemyia vittithorax, Stein.

A very strongly-bristled species, with the abdomen subcylindrical. Stein, at the same time as he described this species, described another under the name *trivittata*, which I have been unable to place very definitely. However, the name is preoccupied by *trivittata*, Stein, a North American species which its describer placed in *Pegomyia*, so that I have not troubled more about the African species. Some other worker having access to the type may rename it if it is distinct from the others in the key.

One male, top of the Aberdares, 9500 feet, 28. ii. 1911 (*T. J. Anderson*).

Hylemyia andersoni, sp. n.

Male.—Black, subopaque, densely brown-dusted. Head black, with grey pruinescence that varies according to the angle from which it is viewed. Thorax very faintly vittate, disc of scutellum darker than margins. Abdomen with a faint central dark vitta which is poorly delimited. Legs black. Wings greyish. Calyptræ and halteres yellowish.

Frons linear above, setulose on anterior half of orbits; parafacial narrow, less than half as wide as height of cheek; antennæ missing in type. Thorax with three or more irregular pairs of short presutural setulæ; prealar absent; dorso-centrals long; sterno-pleurals 1:2. Abdomen narrow, depressed, the dorsal hairs and bristles stiff, but not very long; fifth sternite as described in key. Fore tibia with one antero-dorsal and one posterior bristle, both short; mid-femur with two or three bristles at base on postero-ventral surface; mid-tibia with about three very short posterior bristles; hind femur with three short antero-ventral bristles on apical third and one apical postero-ventral bristle; hind tibia with three postero-dorsal, three or four antero-dorsal, and two antero-ventral bristles, all short. Costal thorn long, setulæ distinct; outer cross-vein straight.

Length 4 mm.

Type, N. of Mt. Kenya, 8300 feet, 18. ii. 1911 (*T. J. Anderson*).

Named in honour of the collector.

Hylemyia flavibasis, Stein.

This is the species described by Adams as *Chortophila linearis*. Stein had, in 1897, used the same specific name for a species of *Hylemyia* from North America, so that the later name *flavibasis* must be used for the species from Africa. Stein did not know that his species was the same as that described by Adams, but I have before me some paratypes of the latter's species, kindly lent to me by Dr. Hunter of the University of Kansas, where the types of Adams's species are located, and there is not the least doubt as to the synonymy.

Stein compared the species with *cilicrura*, distinguishing it from that species by the paler tibiæ, etc.

I have before me specimens from Mt. Chirinda, Mashonaland (*C. F. M. Swynnerton*).

Hylemyia capensis, sp. n.

Male.—Similar to *andersoni* in colour.

Cheek a little higher, parafacial a little wider; arista with distinct pubescence; abdomen broader, processes of fifth sternite over twice as long as wide, slightly pointed at apices, and with long bristly hairs along almost their entire length. Fore tibia with one antero-dorsal and one or two posterior setulæ; mid-femur with one antero-ventral and three or four postero-ventral bristles on basal half; mid-tibia with one or two bristles on each of the following surfaces: antero-ventral, antero-dorsal, postero-dorsal, and postero-ventral, all short; hind femur with a number of long setulose hairs on postero-ventral surface and a complete series of long bristles on the antero-ventral surface, the tips of which are hair-like; hind tibia with two or three antero-ventral, antero-dorsal, and postero-dorsal bristles. Costal thorn distinct; outer cross-vein straight.

Length 4.5 mm.

Type and paratype, Cape Town, viii. 1905 (*G. A. K. Marshall*).

Hylemyia modesta, Stein.

This species I have not seen, but it is closely related to the last, and may be distinguished from it by the characters cited in the key.

Hylemyia griseopunctata, sp. n.

Female.—Head black, frontal triangle and orbits densely pale grey-pruinulent and inter-frontalia opaque black when seen from above, each orbit with a velvety-black spot at base of antennæ, vibrissal angle blackish, remainder of head grey pruinulent; antennæ and palpi black. Thorax black, with a large V-shaped presutural mark and a broad post-sutural fascia deep black, the remainder of surface grey-pruinulent; humeral angles yellow; scutellum opaque black. Abdomen black, densely grey-pruinulent, with shining black marks as follows: a central vitta connected with an anterior and posterior marginal band on each tergite, the fasciæ dilated laterally so that there is a large round spot of the grey pruinulence left on each side of the central black line on each tergite, the tergites thus appearing bipunctate, the extreme sides grey-pruinulent. Legs brownish fuscous, tarsi darker. Wings with a brownish tinge, stem-vein whitish basally. Calyptræ and halteres yellowish.

Frons one-third of the head-width; cruciate frontal bristles present; two bristles anterior to the proclinate orbital; antennæ robust; parafacial linear; cheek about as high as width of third antennal segment; arista pubescent. Thorax with three pairs of presutural acrostichals; prealar bristle of moderate length; sterno-pleurals 2:2, the lower anterior one very fine. Abdomen normal. Fore tibia with one median antero-dorsal bristle; mid-tibia with one anterior and three posterior bristles; hind femur with about four widely-spaced antero-ventral bristles on apical half; hind tibia with three postero-dorsal, four antero-dorsal, and two antero-ventral bristles. Costal thorn small; outer cross-vein slightly curved. Lower calyptra small.

Length 4 mm.

Type, Ulundi, Natal, 5000–6500 feet, ix. 1896 (G. A. K. Marshall).

I have not included this species in my key, as I have no male specimens. It will be readily distinguished from any of the included species, however, by the thoracic markings, which very closely resemble those of many species of the genus *Anthomyia*. It does not belong to the latter genus, however, as the propleura is not furnished with fine hairs in front of the spiracle, the lower calyptra is not larger than the upper, and the abdomen is differently marked from that of typical species of that genus.

Genus *ANTHOMYIA*, Meigen.

In this genus many authors from Meigen until quite recent years were wont to place a rather heterogeneous mass of forms, many of which had only a superficial resemblance to the genotype of *Anthomyia*. In fact, up to some ten years ago there were included such species as *albicincta*, Fallén, *radicum*, Brullé, and *cinerella*, Fallén, all of which are now placed in other genera.

Stein, in his last paper on the European Anthomyiidae, listed only three species of *Anthomyia* from that continent, but he does not make use of the most important character of the genus in differentiating it from its allies, viz., the presence of fine hairs on the propleura below the humeral angle and above the propleural bristle. This character I have used in several of my recent papers on the family, and very rarely indeed do any specimens of the genus have these hairs almost absent.

I present a key for the identification of the species of the genus known to me. This key includes all the described species.

Key to Species.

- | | |
|--|------------------------------|
| 1. Thoracic dorsum with five black postsutural spots; presutural black marks forming two isolated spots; scutellum in female with two black spots at base, in male with the two spots broadly connected; arista with very short pubescence; costal thorn minute..... | <i>indica</i> , sp. n. |
| Thoracic dorsum with four black postsutural marks | <i>plurinotata</i> , Brullé. |
| Thoracic dorsum with either a broad black transverse fascia or three large postsutural black spots, or vittate with fuscous | 2. |
| 2. Costal thorn conspicuous, as long as or longer than the inner cross-vein, the setulæ on costal vein quite noticeable; arista hairs about as long as half the width of third antennal segment; scutellum entirely black or with the extreme apex grey..... | <i>spanigera</i> , sp. n. |
| Costal thorn small or minute, not very distinctly visible | 3. |
| 3. Thorax without well-defined black dorsal marks in front of suture; arista distinctly haired | 4. |
| Thorax with a pair of distinct black spots in front of suture which may be more or less fused anteriorly, or with distinct vittæ which extend the entire length | 5. |

4. Abdomen with first and second visible tergites translucent yellow in male, same tergites usually yellowish in female; scutellum with more than the basal half of disc black; arista longer-haired..... *fasciata*, Walker.
- Abdomen with only the first visible tergite in male yellowish, nowhere yellow in female; less than basal half of scutellum blackish; arista shorter-haired..... *illocata*, Walker.
5. Longest hairs on arista not appreciably longer than its basal diameter..... 6.
Longest hairs on arista distinctly longer than its basal diameter..... 12.
6. Thorax in female with two complete brownish-black vittæ..... *oculifera*, Bigot.
Thorax in neither sex vittate, with presutural and postsutural black markings which are more or less spot-like or fasciform and not connected over suture.... 7.
7. Scutellum in both sexes normally with a black spot on each side of disc at base, the pale grey central mark extending from base to apex..... *pluvialis*, Linné.
Scutellum black, with a more or less pronounced grey apical spot..... 8.
8. Fifth abdominal sternite with a very pronounced rounded lobe at apex of each process on its inner side..... 9.
Fifth abdominal sternite without a pronounced lobe at apex of each process on inner side..... 10.
Fifth abdominal sternite with a very pronounced production of its inner apical margin (see text-fig., p. 270)..... *benquellæ*, sp. n.
procellaris, Rondani.
9. Mesopleura entirely grey pruinosecent.... *procellaris*, var.?
Mesopleura with a brown or fuscous spot in centre.....
10. Presutural pair of black spots extending to anterior margin of thorax; postsutural black spot forming a complete fascia.... *oculifera*, Bigot.
Presutural pair of black spots not extending to anterior margin of thorax; postsutural mark more or less divided by grey lines. 11.
11. Postsutural black mark very distinctly divided by rather broad grey lines..... *pluvialis*, Linné.
Postsutural black mark on thorax indented, but rarely divided by grey lines..... *tempestatum*, Wiede-
[mann.]
12. Bases of femora and middle of tibiae more or less conspicuously yellowish..... 13.
Legs black or fuscous..... 14.
13. Mesopleura with a brown mark over the lower posterior angle in male which is not evident in female; presutural black spots extending to anterior margin of thorax; connecting in front and forming a V-shaped black mark; hind femur without a series of postero-ventral bristles.

- Mesopleura in male without a black mark;
hind femur with an almost complete
series of sparse postero-ventral bristles;
presutural black spots on thorax round,
isolated on disc *ornata*, var. ?
14. Longest hairs on arista at least as long as
width of third antennal segment *plumisetæ*, Stein.
Longest hairs on arista not as long as width
of third antennal segment 15.
15. The dark spot opposite base of antennæ
very conspicuous in both sexes, a choco-
late-coloured spot on each orbit about
middle in female, less distinct in male;
postsutural black mark on thorax com-
plete, not leaving a grey patch behind
suture at sides, and continued down over
pleura, narrowly extending to sterno-
pleura, base of scutellum grey *griseobasis*, sp. n.
Dark spot opposite base of antennæ incon-
spicuous, no spot on frontal orbits in
either sex; base of scutellum black 16.
16. Dark mark opposite base of antennæ not
very conspicuous, or no dark spot at
middle of frontal orbits; base of scutellum
black *abyssinica*, Jaenn.

Anthomyia indica, sp. n.

Male and Female.—General colour as in *pluvialis*, Linné. The two presutural black spots are of moderate size, situated on disc, and not extending to anterior margin nor to suture; behind the suture there are five black spots, the central one elongated, but not extending to posterior margin, the submedian spot slightly elongated and larger than the lateral one, which covers the base of the supra-alar bristle; scutellum with two black spots at base on disc which are broadly connected in the male type and separated in females, the black not extending over sides of scutellum; black mark over prothoracic spiracle rather faint; pleura grey. Visible tergites 2, 3, and 4 each with three subtriangular spots at base which are connected at their bases; hypopygium glossy black. Legs black. Wings hyaline, veins yellow at bases. Calyptræ white.

Head as in *pluvialis*; frons of female as in that species, with two setulæ in front of the proclinate bristle; arista with short pubescence. Thorax normal. Fifth sternite of male as in text-fig. (p. 270). Fore tibia with a median posterior bristle; mid-tibia with the antero-dorsal bristle in both sexes; hind tibia with four or more antero-dorsal bristles, rather uneven. Lower calyptra protruded.

Length 4·5–5·5 mm.

Type, male, allotype, and three female paratypes, Kasauli, N.W. India (*Wyville-Thomson*); two female paratypes, Nainital, Himalayas, India, v. 1900, 7000 feet (*G. M. Giles*).

Anthomyia plurinotata, Brullé.

I have seen no specimens of this European species.

Anthomyia spinigera, sp. n.

Male and Female.—Head black; orbits, face, and cheeks grey-pruinose, the dark spot at base of antennæ, and one



spinigera



longuallae



procellaris



pluvialis



abyssinica



*fasciata
vicarians*



tempestatum



indica



ornata

Right process of fifth sternite of abdomen of males of the genus *Anthomyia*, drawn from the side and much enlarged.

on vibrissal angle distinct. Thorax with a large V-shaped presutural black mark which extends to anterior margin, but not to suture; postsutural black fascia broad and complete, continued down over pleura; scutellum with a very small grey apical spot; a black spot below humeral angle and another on lower posterior angle of mesopleura;

posterior margin of postnotum black. Abdomen slightly yellowish, especially in female, the usual tridentate black markings present, and in addition the extreme anterior lateral angles of tergites black, the central spot elongated, forming a vitta in male. Legs pitchy, sometimes slightly brown, fore coxæ, especially in female, yellowish. Wings clear, veins whitish at bases. Calyptræ white.

Male.—Eyes separated by a mere line at narrowest part of frons, each orbit with about three setulæ; longest hairs on arista fully half as long as width of third antennal segment; parafacial about the same width as latter. Thorax with dorsal bristles longer than usual, one pair of presutural acrostichals much longer than the others; prealar half as long as the bristle behind it. Abdomen narrow, process of fifth sternite as in text-fig. Legs as in *procellaris*; hind femur with some long postero-ventral bristles. Costal thorn fully as long as inner cross-vein, the other setulæ also longer than usual.

Female.—Similar to male, the frons normal, orbits not spotted at middle, and with but one bristle anterior to the proclinate one. Genital paired processes shining black, slender and with fine hairs, the apical one very long.

Length 5–6 mm.

Type, male, allotype, four male and three female paratypes, Kenya Colony.

Anthomyia fasciata, Walker.

A common African species which very closely resembles *illocata*, Walker, the principal distinguishing characters being those listed in the key.

Localities. Gold Coast, Northern and Southern Nigeria, Sierra Leone, and Ashanti.

Anthomyia illocata, Walker.

I have seen this species from Ceylon, Siam, China, Formosa, and the Philippines. I consider it distinct from *vicarians*, though Stein did not.

Anthomyia oculifera, Bigot.

A common North American species which is very readily distinguished by the bivittate thoracic dorsum of the female.

Anthomyia pluvialis, Linné.

A number of specimens of both sexes from Cyprus agree with the characters cited for this species by Stein, though

the definite identification of Linné's species must be attended with considerable doubt. The specimens are smaller and darker than are those of *procellaris*, Rondani, sent to me by Dr. Villeneuve.

Anthomyia tempestatum, Wiedmann.

Stein had some doubt about this species being distinct from *pluvialis*, but it appears to be sufficiently well distinguished from the specimens I identify as the latter to warrant its separation.

Localities. Estcourt, Natal; Blantyre, Nyasaland; Zululand; and Abyssinia.

Anthomyia ornata, Bigot.

A large species, 6–7 mm. in length, with the legs and palpi largely yellowish, a character nearly unique in the genus.

Two specimens, Estcourt, Natal (G. A. K. Marshall); one specimen, Port Natal.

Anthomyia ornata, Bigot, var.?

Two male specimens differ from the typical form as stated in the key.

Localities. Estcourt, Natal (G. A. K. Marshall); Upper Tongaat, Natal (C. N. Barker).

Anthomyia benguellæ, sp. n.

Male.—Similar to *procellaris* in colour. The presutural black spots do not extend to anterior margin of thorax, the scutellum is black except at tip; there is a black mark over prothoracic spiracle and one below wing-base.

Eyes narrowly separated, the orbits contiguous above; arista with very short pubescence. Fifth sternite as in text-fig. (p. 270). Hind femur with some fine bristles on middle of postero-ventral surface.

Female.—Frons one-third of the head-width.

Type, male, and allotype, Benguella, S.W. Africa, 300 miles from the coast, xii. 1904 (F. C. Wellman).

A female of apparently the same species from Zomba, Nyasaland.

Anthomyia procellaris, Rondani.

I have before me French specimens of this species sent to me by Dr. J. Villeneuve. These differ from two German

specimens, and one from Natal, in having no mark on the mesopleura. Lack of material prevents me forming a definite opinion on the identity of the European species of this genus other than that given by Stein.

Anthomyia plumiseta, Stein.

This species, described from Formosa, is unknown to me, except from Stein's work.

Anthomyia griseobasis, sp. n.

Female.—Frons with a conspicuous brown spot on each orbit at the proclinate bristle, and an evident brown band across frons at same point; the dark marks at base of antennæ and on vibrissal angle conspicuous; longest hairs on arista about three times as long as its basal diameter. Presutural black spots on thorax large and elongate; post-sutural black mark forming a complete transverse fascia, and extending down below base of wing on pleura; scutellum with the extreme base and the tip grey; a black streak above prothoracic spiracle. Median black marks on dorsum of abdomen forming a complete vitta, narrowly connected along base of each tergite with the lateral spots. Legs black. Fore tibia with an antero-dorsal and a posterior median bristle.

Male.—Similar to the female, but the dark mark on middle of orbits is much less distinct. The processes of fifth sternite are much as those of *ornata*.

Length 5-5.5 mm.

Type, female, Estcourt, Natal, 10. ii. 1913 (*R. C. Wroughton*). Allotype, Bohotle, Somaliland. Paratypes, one female, Ulundi, Natal, 5000-6500 feet, ix. 1896 (*G. A. K. Marshall*); one male, Kenya Colony.

Anthomyia abyssinica, Jaenn.

This species, to which I refer three males now before me, is very close to the preceding one. The scutellum is not grey at base, and the arista has the longest hairs not twice as long as its basal diameter.

Length 6 mm.

Locality. Estcourt, Natal (*G. A. K. Marshall*).

I suspect that this is the species described by Stein as *maculigena*, but an examination of the types of the two species is essential to a determination of this.

Ann. & Mag. N. Hist. Ser. 9. Vol. xiv. 18

Anthomyia vicarians, Schiner.

I have seen this species only from Australia, and consider that it is distinct from *illocata*, Walker, though Stein decided that they were synonymous.

GENUS ANAPHALANTUS, Loew.

This genus belongs to the subfamily Cœnosiinæ, a key to the African genera of which I presented in Part VIII. of this series of papers*.

Stein in his Catalogue of the Anthomyiidae of the world † lists *pennatus*, Loew (with *squamitibia*, Stein, as a synonym), as the only species of the genus. He evidently overlooked *A. pictus*, Johnson, described from Somaliland ‡.

A more excusable oversight was *Lauzanacanthus barbipes*, Bigot, described from Madagascar, as belonging to the Lauzaniinæ §.

Apart from the colour of the legs, there is nothing in the descriptions listed that would justify one in considering them as a distinct species. It is highly probable that all the names apply to one species, the first name being *pennatus*, Loew (1857).

GENUS ORCHISIA, Rondani.

This genus occurs in Europe, Africa, China, and Formosa, so far as I know at present. It belongs to the subfamily Cœnosiinæ, and is included in the generic key referred to above.

Johnson redescribed the only species—*costata*, Meigen—as *Cœnosia marginipennis* in the paper on Somaliland Diptera referred to above.

XXXI.—*Descriptions and Records of Bees*.—CII.

By T. D. A. COCKERELL, University of Colorado.

HYLÆUS, Fabricius.

The species of the Maritime Province of Siberia, treated below, are related to those of Europe rather than to the fauna of the desert regions of Turkestan and Mongolia, whence

* See Ann. & Mag. Nat. Hist. vol. x. p. 575 (1922).

† Arch. f. Naturges., Jahr. 1917, Abt. A, Heft 1 (1919).

‡ Proc. Acad. Nat. Sci. Philadelphia, p. 182 (1898).

§ Ann. Soc. Ent. France, p. 553 (1859).

numerous species were described by Morawitz. *H. sibiricus* (Strand), with ivory-white face in the male, is not like any form obtained by me. In spite of a close general resemblance to the European *Hylæus*, I cannot identify any of my species with them, not even with those which are known to extend into Asia.

Hylæus transversalis, sp. n.

♂.—Length about 6.5 mm., anterior wing 3.5.

Black, with dull orange face-marks, a pair of yellow stripes on prothorax above, yellow tubercles (the yellow having the outline of a mushroom), and the following leg-markings: cream-colour, stripe on anterior tibiæ, middle tibiæ at base, nearly basal half of hind tibiæ, basitarsi except at apex; labrum black; face broad; clypeus orange except a sutural stripe on each side, not reaching either end; lateral marks cuneiform, filling space between clypeus and eye, and reaching antennal sockets, obliquely truncated above, ending in a point on orbits slightly above level of antennæ; supraclypeal area entirely black; scape ordinary, with a broad yellow stripe; flagellum dusky reddish beneath; mesothorax and scutellum densely and distinctly punctured; punctures of scutellum large; area of metathorax with strong transverse plicæ; tegulæ with a light spot. Wings dusky hyaline; second cubital cell very broad; first recurrent nervure meeting first intercubitus. Spurs white. Abdomen highly polished, without patches of hair, first segment under a microscope with fine and sparse piliferous punctures on a smooth surface, but under a lens seeming impunctate; venter without hair-bands.

Okeanskaja, Siberia, Aug. 5 (*Cockerell*), 1 ♂.

A very distinct species, by reason of the sculpture of metathorax recalling *P. krieckbaumeri*, Foerst., but easily distinguished by the yellow stripe on scape and lack of white fringes on ventral segments of abdomen.

Hylæus sinicola, sp. n.

♀.—Length about 6 mm., anterior wing 4.3.

Black, with the face entirely black, but the following lemon-yellow—tubercles broadly, spot on tegulæ, anterior and middle tibiæ narrowly at base, somewhat less than basal half of hind tibiæ, the colour on the last paler; head broad, with nearly circular outline; clypeus dull; front conspicuously punctured; facial foveæ long, not far from orbits; scape ordinary, black; flagellum, except at base, ferruginous beneath; mesothorax and scutellum dullish, strongly

punctured; area of metathorax sharply defined, with strong widely separated longitudinal rugæ, and a transverse keel in middle, the lateral enclosed spaces are very long, and there is no marginal series of pits. Wings rather strongly dusky; second cubital cell receiving first recurrent nervure near its base. Abdomen highly polished, without hair-bands or patches, first segment under microscope showing very widely scattered and few excessively minute punctures.

Okeanskaja, Amur Gulf, Aug. 5 (*Cockerell*), 1 ♀.

No male in the collection can possibly be conspecific. In Alfken's table it falls near to *H. rinki*, Gorski, differing by the flagellum red beneath and the facial foveæ very near to eye.

Hyleus cardioscapus, sp. n.

♂ (type).—Length about 6 mm., anterior wing 4.4.

Black, the thorax with thin but evident pale hair, abdomen without hair-bands; head broad; face below antennæ concave in profile, bright orange, the lateral marks ending broadly obliquely at level of antennæ, with a black wedge between them and orbits; labrum black; cheeks strongly punctured; scape excessively broad, heart-shaped (though not emarginate above), with distinctly less than the outer half yellow; flagellum long, entirely black; mesothorax and scutellum moderately shining, strongly punctured; tubercles lemon-yellow apically; tegulæ with a small yellow spot; area of metathorax with strong irregular rugæ, apical part sculptured, no marginal row of pits. Wings conspicuously brownish; first recurrent nervure meeting intercubitus; second cubital cell very broad above. Abdomen with a very fine pruinose pubescence; first segment polished, under microscope showing weak sparse piliferous punctures, remaining segments evidently finely punctured under a lens. Anterior tibiæ broadly in front, middle tibiæ at extreme base, about basal two-fifths of hind tibiæ, and middle and hind basitarsi yellow.

♀.—A little larger, robust, with the same broad second cubital cell; face-marks reduced to lateral stripes, which extend only a short distance above level of top of clypeus; tubercles yellow at end, tegulæ entirely dark; legs black, with only about basal third of hind tibiæ yellow; lower part of facial foveæ separated from orbits by two rows of punctures; apical part of metathoracic area sculptured.

Kudia River, Siberia, July (*Cockerell*), 10 ♂, 2 ♀.

The female is very like *H. brevicornis* (Nyl.), but differs by the absence of a yellow line on prothorax above, by the much less punctured first abdominal segment, and other characters.

The male in Alfken's Bremen table runs out at 5 because of the black flagellum. Among the numerous European males examined, there was nothing closely similar. Among the Japanese species, *H. nipponicus*, Bridw., is somewhat similar. The seventh ventral plate of *H. cardioscapus* is closely similar to that of the American *H. varifrons* (Cress.), with the same long hairless basal lobes. The genitalia resemble *H. varifrons* very closely in the stipites, but the sagittæ are different, being produced into long slender finger-like diverging ends. The male scape is much larger than in *varifrons*, and the face is more deeply coloured, but the species are closely allied.

Hyleus nigrocuneatus, sp. n.

♂ (type).—About 6 mm. long.

Very close to *H. difformis* (Eversm.), differing thus: face-markings lemon-yellow instead of orange; between clypeal mark and lateral face-marks at lower end a variable wedge-shaped black area, so that the clypeal mark is narrower apically; lateral marks, instead of being excavated on outer side above as in *difformis*, continuing with a curve to a projecting tooth-like point, mesad of which the upper end of the lateral mark is squarely truncate; scape very robust, entirely black, but only about half the size of that of *difformis*; the dense punctures of mesothorax conspicuously smaller; wings pale greyish (strongly reddened in *difformis*); hind tibiæ with less yellow at base. There is no supraclypeal mark, and the black area from clypeus to level of upper inner corners of lateral marks is broader than long, considerably shorter than the same area in *difformis*.

♀.—Face black, with broad but rather short lemon-yellow lateral marks, shaped about as in *H. modestus* (Say); one row of punctures between facial foveæ and orbits; tubercles broadly yellow; tegulæ entirely dark; wings dilute greyish; hind tibiæ with about basal fourth yellow; first abdominal segment with excessively fine and sparse punctures, impunctate in middle.

Kudia River, Siberia, 3 ♂, July (*W. P. and T. D. A. Cockerell*); Okeanskaja, Aug. 5, 1 ♀ (*Cockerell*).

The female will not run in Alfken's table to *H. difformis*, because the abdominal segments have no white fringes, merely a very delicate pruinosity due to minute hairs. This female is really very like that of *H. hyalinatus* (Smith), but the latter has much narrower lateral face-marks, spotted tegulæ, and the rugæ on the metathoracic area much weaker and more irregular. In *hyalinatus*, the apical part of area is

microscopically transversely lineolate, in *nigrocuneatus* it is extremely minutely reticulate. The male abdominal organs of *H. nigrocuneatus* show the following characters: eighth ventral plate of the general type of *H. rudbeckiæ* (Ckll. & Csd.), but the lateral extensions of the apical lobes are much larger, and are beset with curious short thick hairs, bent at about a right angle in the middle. The seventh ventral plate has short basal lobes as in *H. rudbeckiæ*, but the broad hyaline flaps extend on each side of the wings much as in *H. varifrons*, except that they are broader and curve downward. The row of hairs is peculiar, the hairs being strap-like. In the genitalia, the very stout dark brown stipites are suddenly contracted at the end to hyaline processes shaped like the end of a finger, and bearing short bristles on the inner side. The sagittæ are broad, strongly curved, and not especially long.

Hylaüs nigrocuneatus, var. *a*.

♂.—A little smaller; scape not quite so stout, and with a curved yellow line in front; tegulæ with or without a yellow spot.

Kudia River, Siberia, 3 ♂ (*W. P. and T. D. A. Cockerell*). The European *H. difformis* varies in a similar manner.

Hylaüs nigrocuneatus, var. *rustipennis*, nov.

♂ (type).—Wings strongly reddish instead of greyish; scape with a yellow line; tegulæ with a minute spot. In both this and the typical form the hind basitarsi are pale yellow at base. This resembles *H. difformis* in the reddened wings.

♀.—Wings reddish; lateral face-marks distinctly triangular.

Okeanskaja, Siberia (type-locality), 1 ♂, 1 ♀ (*W. P. and T. D. A. Cockerell*); Kongans, 1 ♂, 1 ♀ (*Cockerell*).

Hylaüs monostictus, sp. n.

♀.—Length about 5.5 mm., anterior wing 4.7.

Black, with broad cuneiform lateral face-marks, small spot on middle of apical part of clypeus, and ends of tubercles rather broadly, lemon-yellow; antennæ, tegulæ, and legs black, the hind tibiæ rather broadly yellow at base; pubescence extremely scanty, abdomen with very thin hair-bands on apices of segments 1 to 3, broadly failing in middle; head oblong, face broad; clypeus dull, distinctly but sparsely punctured; mesothorax dull, very closely and

finely punctured; scutellum moderately shining, with large well-separated punctures; area of metathorax poorly defined, the median basal part with coarse anastomosing wrinkles, apical part microscopically reticulate, and sides with extremely fine wavy lines, no marginal series of pits; sides of metathorax finely pruinose-pubescent. Wings hyaline, faintly greyish, second cubital cell long, first recurrent nervure meeting intercubitus, or going to extreme apical corner of first cubital cell. Abdomen broad, highly polished, with very fine sparse punctures, appearing impunctate under a lens. One row of small not very close punctures between facial foveæ and orbits—these separated from the fovea, even below, by less than the width of a puncture. Region laterad of each antenna with microscopical longitudinal striæ. The lateral face-marks are cut off very obliquely above; they differ from those of *P. zizia*, Rob., in having the upper inner side much shorter than the lower.

Preobrageniya Bay, Siberia, July 12 (*Cockerell*).

H. asiaticus, D. T., has the yellow spot on the clypeus, but the mesothorax is shining and sparsely punctured. In *H. cognatus*, Pér., and *H. pictipes*, Nyl., the yellow clypeal spot may be present or absent. The lateral face-marks of *H. pictipes* are cut off below, and in various respects this species is quite unlike ours. *H. cognatus* is also a different thing, found in France and Spain.

Hylæus pallescens, sp. n.

♀.—Length about 5.5 mm., anterior wing 4.8.

Black, the thorax very robust, the abdomen fusiform, broad at base; black, with very scanty pubescence, the markings of head, thorax, and legs white (pinkish white on face); clypeus black, very obscurely reddish at lower corners; lateral marks very long, sharply pointed below, filling space between clypeus and eye, above obliquely truncate at level of antennæ; upper border of prothorax with an interrupted band, tubercles apically and large spot on tegula white; basal part of anterior tibiæ in front, and broad base of hind tibiæ, white or whitish; head oblong, clypeus dull, with a slight silky lustre; flagellum obscured reddish beneath; facial foveæ very close to eye, with one row of punctures between; mesothorax dullish, very densely but distinctly punctured, scutellum more shining; area of metathorax cancellate with anastomosing rugæ, laterally sharply defined, and with very delicate cross-plicæ, but no series of pits, apical part not evidently sculptured. Wings greyish-hyaline, first recurrent

nervure meeting intercubitus. Abdomen with very delicate pruinose pubescence, giving a faint suggestion of broad apical bands at sides of segments; first segment highly polished, with extremely fine sparse punctures (as seen under microscope), but they are more numerous and distinct than in most other Siberian females.

Okeanskaja, Siberia, Aug. (*Cockerell*), 1 ♀.

This may be compared with *H. nigrinus* (Fab.), from which it is easily known by the shape of the lateral face-marks and much finer punctures of mesothorax.

Hylæus wilmattæ, sp. n.

♂ (type).—Length about 5.5 mm., anterior wing 4.2.

Black, robust, with broad thorax; pubescence very scanty, abdomen finely pruinose, the sides of first segment with some suggestion of a band; face broad, entirely bright lemon-yellow below level of antennæ; supraclypeal mark extending between antennæ, and slightly notched; lateral marks obliquely truncate, reaching orbital margins at an angle of about 45 degrees, the upper inner margin more or less irregular or notched (all essentially as Metz figures for *H. modestus*, Say); labrum black, but mandibles with a yellow line; scape ordinary, with a yellow stripe on outer side; flagellum dark brown above, pale ferruginous beneath; head oblong; prothorax black, the tubercles narrowly edged with yellow; mesothorax and scutellum very densely but distinctly punctured; area of metathorax with strong longitudinal rugæ on upper surface, the margin sharply defined, no basal series of small pits; tegulæ dark brown, with a small spot. Wings dusky reddish; first recurrent nervure meeting intercubitus. Anterior tibix pale reddish in front; spot at base of middle tibix, base of hind tibix broadly, and basitarsi except apex, cream-colour. Abdomen broad, second and third segments with wide transverse subapical depressions; first abdominal segment with very fine piliferous punctures and delicate transverse striæ.

♀.—Yellow on face confined to lateral marks, which are cuneiform, bright lemon-yellow, with the upper side extremely oblique, and the point a little away from orbital margin (style of *H. nalumbonis*, Rob., but tips acute); lower margin of clypeus broadly but obscurely red; flagellum black above, obscure red below; tubercles broadly yellow at end, but tegulæ without a spot; legs black, with hind tibix pale yellow at base; area of metathorax of same type as in female; first abdominal segment with extremely fine and sparse

piliferous punctures, and faint cross-lineolation; facial foveæ close to eye, with one row of punctures between.

Kudia River, Siberia (type-locality), July, 1 ♂, 2 ♀ (*Wilmatte* P. Cockerell); Kongaus, Aug., 1 ♂ (*Cockerell*).

A species of the "*modestus* division" of Metz, with North American affinities. The male in Alfken's Bremen table runs to *H. annulatus* (L.), but is easily separated by the face-markings, which are bright lemon-yellow, although the pattern is practically the same. The metathorax and robust abdomen of *H. wilmatte* are also distinctive.

Hylæus polevoia, sp. n.

♂ (type).—Length about 5 mm., anterior wing 4.

A species with large circular scape, the outer half yellow, and bright lemon-yellow face, at first sight appearing to be *H. cardioscapus*, but easily distinguished thus: considerably smaller; face not shining; supraclypeal mark short, its broadly rounded apex not far above inner corners of lateral marks; lateral marks oblique above, ending in a point little removed from orbit (face-marks in style of *H. modestus*); flagellum pale dull ferruginous beneath; thorax less robust; area of metathorax with much more delicate sculpture, and a series of marginal pits; basal nervure less arched, falling considerably short of nervulus (this character enabled me to decide between two sets of females which it seemed might belong here); legs from knees beyond pale yellow, except that small joints of tarsi are light ferruginous, anterior and middle tibiae have a broad saddle-like black patch, and hind tibiae a broad subapical black ring. The first abdominal segment is distinctly but sparsely punctured.

♀.—Yellow on face confined to narrow lateral stripes; tubercles pale at end, and a spot on tegulae. I had at first confused this female with that of *H. cardioscapus*, but it is narrower, with the tegulae more or less spotted (the spots large in Okanskaja specimen, small and inconspicuous in those from Kongaus) and the apical part of mesothoracic area not distinctly sculptured. The row of large punctures between facial foveæ and orbits has an undulating form, the alternate punctures being placed to one side, and there is also a row of extremely minute punctures.

The male type was taken at Okanskaja, Aug. 5 (*Cockerell*). I collected three females in August, one at Okanskaja, two at Kongaus.

The species is dedicated to Mdme. Polevoi of Vladivostok, whose kindness made it possible for us to collect extensively

at Okeanskaja. The male runs in Alfken's Bremen table to *H. euryscapus*, Foerst., but has more yellow on tubercles and hind tibiae. Compared with *H. variegatus* (Fab.) it is much smaller, with much more finely punctured mesothorax.

Hylæus concinnus, sp. n.

♂.—Length about 4.5 mm., anterior wing 3.9.

Black, rather slender, with very scanty pubescence; head broad, but orbits very strongly converging below; face below antennæ bright but not very deep orange, supraclypeal mark short, narrowed above, lateral marks broad, rounded or subtruncate above, the highest point away from orbit, the inner apical side undulate (these markings in style of *H. zizia*, Rob., but lateral marks shorter above, and not excavated by antennal sockets); face dull, not polished; labrum and mandibles black; scape stout, shining, entirely black, flagellum bright ferruginous beneath; mesothorax dull, very closely and finely punctured; scutellum more shining, well punctured, with a shallow median depression; tubercles yellow at end, tegulae wholly black; area of metathorax distinctly defined, with irregular anastomosing rugæ, which extend over to the apical space. Wings greyish hyaline; second cubital cell rather short; first recurrent nervure joining apical end of first cubital cell. Anterior tibiae (except behind) and tarsi pale red, yellowish at knees; middle tibiae narrowly light at base, but hind ones with more than basal third light yellow; middle and hind basitarsi pale yellow, the small joints reddened. Abdomen polished, first segment with extremely fine and sparse piliferous punctures on a smooth surface.

Kudia River, Siberia, July, 1 ♂ (*Cockerell*).

In Alfken's Bremen table runs nearest to *H. annulatus*, which it does not resemble. It really resembles very much the American *H. sayi*, Rob., differing by having the face more narrowed below, and the lateral marks broader, and less produced above.

Hylæus lepidulus, sp. n.

♂.—Length hardly 4 mm., anterior wing 3.

Black, slender, thorax with fine white pruinose pubescence; orbits converging below; face below antennæ very pale yellow, supraclypeal mark short, very obtuse above, lateral marks ending broadly at lower level of antennal sockets,

emarginate apically (pattern somewhat as in *P. potens*, Metz, but face much more narrowed below, and lateral marks with highest apical point next to antenna); scape rather short, entirely black; flagellum long, clear ferruginous beneath; labrum and mandibles black; mesothorax and scutellum dullish, very finely punctured; tubercles and tegulæ entirely black; area of metathorax rather poorly defined, with fine longitudinal rugæ, the apical part microscopically reticulate. Wings greyish hyaline, faintly reddish; stigma reddish; first recurrent nervure meeting intercubitus. Anterior tibiæ in front, middle and hind ones at base (the latter nearly the basal half) and narrowly at apex, and the basitarsi, very pale yellowish; small joints of tarsi pale reddish. Abdomen polished, rather constricted at base of second segment, first segment with fine and sparse piliferous punctures, the surface rather hairy. The abdomen is obscurely reddish.

Kudia River, Siberia, July, 1 ♂ (*Cockerell*).

A distinct little species, to be compared with *H. alpinus*, Morawitz, but the face is smaller and yellower, the flagellum longer, &c.

XXXII.—*The Iridescent Species of Euselasia* [*Lepidoptera*].

By PERCY I. LATHY, F.E.S.

THESE beautiful butterflies are always very rare in collections, and up to the present time but three species were known.

The first described was *opalina*, Westw., 1851, then *opalescens*, Hew., 1854, and afterwards *præclara*, Hew., 1869.

In describing this latter, Hewitson says "one of the most glorious things in this part of the Creation, surpassing the *Morphos*."

On paying a visit to a Parisian dealer a short time ago, I was delighted to find, among other Amazonian *Lepidoptera*, a most beautiful new species of this group. The same day I went to show my acquisition to my friend M. Le Cerf of the Paris Museum, who said that there were but two specimens belonging to two different species in the museum collection, and when he showed them to me, to my great astonishment, I found one of these to be another very distinct new species.

A careful examination of the specimen from French

Guiana in Madame Fournier's collection, which hitherto had been placed under the name of *opalescens*, revealed certain differences from the typical form, and, as the localities of the two are so wide apart, I think that the Guiana form may be regarded as a subspecies. Mr. Talbot, on examining the series of *opalescens* in the Joicey collection, found that the specimens from Ecuador differed from those of Brazil, and kindly sent me the description for publication in this paper.

I give a key by which the five species may be easily distinguished from one another and also detailed descriptions of the new species and subspecies:—

A. Ground-colour above orange-brown.

*a*¹. Without violet tinge.

*a*². Apex of fore wing broadly bordered with blackish brown.

*a*³. Fiery orange reflection *opalescens*.

*a*⁴. Greenish-blue reflection *præclara*.

*b*². Apex of fore wing not bordered with blackish brown *opalina*.

*b*⁴. Ground-colour above with strong violet tinge *violacea*.

B. Ground-colour violet-blue *fournieriæ*.

Euselasia violacea, sp. n.

♂. *Upperside*.—Both wings above as in *opalescens*, Hew., but with a strong violet tinge. The reflections are much more greenish than in *opalescens*, and are thus intermediate between that species and *præclara*.

Underside.—Fore wing whitish, an elongated blackish spot between veins 1 and 2 not far from anal angle; a submarginal row of very faint greyish lines. Hind wing whitish; a submarginal row of nine minute black spots, of which the middle one is the largest.

Bogota, Colombia.

One male in the Paris Museum. It can easily be distinguished from *opalescens* by its strong violet tinge on both wings above and absence of discal markings on both wings below.

Euselasia opalescens interrupta, subsp. n.

♂. *Upperside* similar to the typical form. *Underside*.—Fore wing with discal line less pronounced and the spots composing it more widely separated. Hind wing with upper part of discal line composed as follows: two fairly large spots on costa, a minute dot beyond and a spot below cell.

Lower Maroni, French Guiana.

1 ♂ in coll. Fournier.

May be separated from typical *opalescens* from Brazil by its smaller size and the greatly broken up discal line of hind wing below.

Euselasia opalescens joiceyi.

Fore wing above with the opalescence more extended costally.

Underside of fore wing with the discal line composed of 6 small spots, and thinner than in the type-form, where it is only broken at veins 4 and 6. The black spot near tornus is smaller.

Hind wing: the costal spot in 7 is larger and somewhat rounded, the spot below it is a round dot, the discocellular mark short and feeble, the mark in 1c is similar to the mark in 1b and not curved out as in the type, the antemarginal line is fainter, lighter yellow, and emphasised on veins 2 and submedian by a bright yellow thickening.

Coll. Joicey. 5 ♂♂, Ecuador, ex Coll. Gr.-Smith.

Quite a distinct race, easily recognised by the more broken, thinner, and shorter discal line on the fore wing.

Euselasia fournierae, sp. n.

♂. *Upperside*.—Both wings violet-blue, somewhat darker towards apex and margin. The reflections in certain lights are of a most brilliant violet-blue and in others the blue is mingled with green and fiery orange.

Underside.—Fore wing whitish clouded with grey towards outer margin; a faint brown spot at end of cell; an irregular discal brown line and a submarginal row of linear dark lunules. Hind wing whitish, a discal row of brown spots as follows: one below costa, three beyond cell, and three towards anal angle; beyond these spots a cloudy grey line and a submarginal row of linear dark lunules; a very thin marginal orange line.

Manaos, Amazon.

1 ♂, Coll. Fournier.

The blue ground-colour of the upperside without the slightest trace of orange-brown distinguishes this species from all its allies.

XXXIII.—*New Callicebus, Conepatus, and Ecomys from Peru.* By OLDFIELD THOMAS.

IN a small collection made by Mr. Latham Rutter at Moyobamba and Chachapoyas in North Peru there occur examples of the three following mammals, which appear to deserve description as new:—

Callicebus oenanthe, sp. n.

A pale grey species, much less rufous than other Peruvian forms.

General colour above grizzled buffy greyish, not strongly rufous, paler than in any species except *C. pallescens*. Bases of the hairs blackish brown, then dull buffy, the ends tipped or ringed with dark brown. Hinder back and thighs warmer buffy, this colour extending down the hinder side of the legs. Under surface dull ochraceous rufous throughout, on body and inner side of limbs. A supraorbital band whitish. Crown pale buffy brownish. Hairs on ears grizzled greyish, like back. Hands and forearms pale brownish, nearly matching the crown; fingers dull whitish. Hind feet dull brownish ochraceous, the digits lighter. Tail grizzled brownish above and below, the end very slightly lighter.

Dimensions of the type:—

Head and body 300 mm.; tail 392; hind foot 93; ear 30.

Skull: greatest length 63; condylo-basal length 51; front of canine to back of m^3 18.

Hab. Moyobamba, N. Peru. Alt. 2700'.

Type. Adult male. B.M. no. 24. 7. 11. 1. Original number 490. Collected 14th January, 1924, by Latham Rutter. Presented by Oldfield Thomas. Four specimens.

This well-marked species is widely different from any of the other Titi monkeys of this part of S. America, as they are all much more strongly ochraceous, rufous, or grey. It is most similar to *C. pallescens* of the Paraguayan Chaco, but that is even lighter in colour, and, of course, can have no special relationship to it.

Conepatus inca taxinus, subsp. n.

Mr. Rutter obtained at Chachapoyas a nice series of seven specimens of the local skunk, and on comparison of these

with four skins of their only ally, *C. inca*, of Central Peru, I find that externally they have the white stripes longer, broader, and more solid, and there is much more white in the tail.

In the skulls, while that of true *inca* is particularly smooth and little ridged, either in male or female, that of the North Peruvian animal is strongly ridged, with the sagittal crest strongly developed from the level of the hinder edge of the orbits backwards, even a young specimen having a commencing ridge in the central line. And the lambdoid ridge is, of course, developed in proportion. Mastoid breadth usually greater. This skunk is therefore evidently a more robust animal, with greater biting powers, and, as this difference runs throughout the series of the two forms, it would seem to deserve recognition by name.

Dimensions of type:—

Head and body 413 mm.; tail 233; hind foot 76; ear 25.

Skull: greatest length in middle line 81; condyle-basal length 78; zygomatic breadth 48; mastoid breadth 42; greatest diameter of m^1 11.

Hab. Chachapoyas, N. Peru. Alt. 7700'.

Type. Adult male. B.M. no. 24.7.11.10. Original number 621. Collected 27th March, 1924, by L. Rutter, and presented by Oldfield Thomas.

Geographically the only near neighbours of this skunk are, to the north, *C. quitensis*, Humb., of Ecuador, a much larger and more heavily white-striped form, and to the westward, in the coastal desert, *C. zorrino*, Thos.*, which has its pelage of a totally different character.

"The skunks are very easy to catch. You go up the mountain at night, and by the light of the moon can see them digging for grubs; you then approach quickly and drop a lasso over their heads."—*L. R.*

Ecomys osgoodi, sp. n.

A medium-sized species allied to *E. palmeri*, but smaller.

Size rather less than in *E. palmeri*, the feet markedly shorter. Fur close and fine. General colour above warm brown, finely ticked with buffy or ochraceous. Sides little clearer, though there is a slightly marked ochraceous lateral line. Under surface rather muddy-coloured, the hairs broadly

* *C. zorilla*, Thos. Ann. & Mag. Nat. Hist. (7) v. p. 217 (1900); renamed *C. zorrino*, op. cit. (7) viii. p. 528, footnote (1901).

slaty at base, buffy or soiled whitish for the narrow tip, the resulting colour much darker than in *palmeri*; a spot on throat white to the bases of the hairs. Ears of medium size, contrasted blackish. Hands brown on metacarpals, digits white. Feet wholly brown. Tail of medium length, very finely scaled, thinly hairy, not pencilled, uniformly dark brown above and below.

Skull convex above, with rather large rounded brain-case and short muzzle. Nasals peculiarly small and narrow, as is characteristic for *Ecomys*, but even more so than in *palmeri*. Interorbital region with well-developed divergent ledges overhanging the orbits, and running backwards across the parietals to the corners of the interparietal. Zygomatic plate more projected forward than is usual in *Ecomys*, not undercut, and even a little slanting backwards. Palatal foramina of medium length, not reaching to the level of m^1 . Bullæ small.

Dimensions of type:—

Head and body 120 mm.; tail 140; hind foot 25; ear 19.

Skull: greatest length 31·7; condylo-incisive length 28·6; zygomatic breadth 16·6; nasals $11 \times 3\cdot4$; interorbital breadth 5·5; breadth across parietal ridges 13·2; zygomatic plate 3·5; palatilar length 14; palatal foramina 5·5; upper molar series 5·2.

Hab. Moyobamba, N. Peru. Alt. 2700'.

Type. Adult female. B.M. no. 24. 7. 11. 16. Original number 500. Collected 16th January, 1924, by Latham Rutter. Presented by Oldfield Thomas. Two specimens.

This is a very distinct species, differing from its only near ally, *Æ. palmeri*, by its shorter feet, darker-coloured belly, and more rounded skull. Like its ally, it is not strongly marked as an *Ecomys*, showing more affinity with *Oryzomys*, but seems, on the whole, to be best placed in the former genus.

I have named it in honour of my friend Mr. Wilfred Osgood, to whose journey across this part of Peru, with the collections he obtained, and the paper he wrote upon them, we are indebted for a large part of our scanty knowledge of N. Peruvian mammalogy. And no one else has done so much to clear up the nomenclatural history of S. American mammals.

“Caught in forest.”—*L. R.*

XXXIV.—*New or little-known Tipulidæ (Diptera).*—XXIV.
Australasian Species. By CHARLES P. ALEXANDER, Ph.D.,
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 Massachusetts, U.S.A.

THE species described at this time are all from New Zealand, where they were collected by my friends, Messrs. Campbell, Hamilton, Harris, Howes, Jensen, Myers, and Oliver, in various parts of the main islands and in Stewart Island. The types of the novelties are preserved in the writer's collection.

Dicranomyia acanthophallus, sp. n.

General coloration dark grey; antennæ black throughout; halteres pale, the knobs infuscated; wings subhyaline, stigma oval, vein *Cu* faintly seamed with darker; male hypopygium with the ædeagus provided with small spines and tubercles.

Male.—Length about 4 mm.; wing 6·8 mm.

Rostrum and palpi black. Antennæ black, the flagellar segments oval. Head blackish, pruinose, the anterior part of the vertex lighter grey.

Pronotum dark grey. Mesonotum dark brownish grey, the latter shade being produced by a pruinosity, the præscutum without distinct stripes; median area of scutum, the scutellum, and postnotum light grey. Pleura light grey. Halteres pale, the knobs infuscated. Legs with the coxæ infuscated, pruinose basally, the apices pale; trochanters brownish testaceous; femora brownish testaceous, the tips passing into dark brown; remainder of the legs brown, the tarsi passing into black. Wings subhyaline, the stigma oval, rather pale brown; a very vague pale seaming along the cord and outer end of cell 1st *M*₂; vein *Cu* in cell *M* seamed with brown; veins dark brown. Venation: *Sc*₁ ending opposite the origin of *Rs*, *Sc*₂ some distance from its tip, *Sc*₁ alone being a little shorter than the basal deflection of *Cu*₁; *Rs* weakly angulated and slightly spurred near origin; basal deflection of *R*₂₊₃ subequal to or a trifle longer than the basal deflection of *R*₄₊₅; cell 1st *M*₂ rectangular; basal deflection of *Cu*₁ immediately beyond the fork of *M*.

Abdomen brown. Male hypopygium with the basistyles relatively small with a conspicuous mesal fleshy lobe. Ventral basistyles large and fleshy, the rostrum relatively short, with two relatively long, nearly straight spines, situated close together near mid-length of the caudal face

of the rostrum, one spine a little shorter than the other. Dorsal dististyle not strongly curved, bent subangularly, the long apex suddenly narrowed, acute. Gonapophyses with the mesal apical lobe relatively slender, curved, the extreme tip directed laterad, the lateral margin before the apex slightly roughened or subspinose; the lateral edge of each apophyse slopes rapidly basad, with a powerful chitinated rod running from near mid-length to the base of the ædeagus. *Ædeagus* broad, feebly dilated beyond mid-length, the surface set with numerous sharp microscopic spines, larger near the postmedial dilated portion, becoming smaller and more tuberculate before the tip; base of ædeagus with a few powerful setæ.

Hab. New Zealand (South Island).

Holotype, ♂, Glenorchy, Otago, altitude 1200 feet, December 27, 1923 (*F. S. Oliver*).

In its general appearance, *Dicranomyia acanthophallus* is not unlike a small *D. cinerella*, Alexander, but differs from all New Zealand species of the genus so far described by the spinous ædeagus.

Dicranomyia otagensis, sp. n.

Allied to *D. annulifera*, Alexander; mesonotal præscutum dull; wings yellowish subhyaline, the stigma pale; abdominal segments bicolorous, the apex of each infuscated; basistyles of hypopygium with a small setiferous tubercle on mesal face at base.

Male.—Length about 7 mm.; wing 7.6–8.2 mm.

Female.—Length 7–8 mm.; wing 8–9 mm.

Rostrum and palpi black. Antennæ black, the scapal segments pruinose; flagellar segments oval. Head dark grey medially, the anterior part of the vertex silvery grey, the sides of the vertex behind more or less infuscated.

Pronotum brownish black, pale laterally. Mesonotal præscutum varying from pale to darker brown, opaque, pruinose, the lateral margins brighter-coloured, yellowish; remainder of mesonotum light brown, the scutellum somewhat more pruinose. Pleura brownish testaceous, sparsely pruinose. Halteres greenish white, the base of the stem paler, the knobs more or less infuscated. Legs with the coxæ pale, sometimes strongly greenish, the fore coxæ a little infuscated basally; trochanters greenish; femora brownish yellow; remainder of the legs dark brown. Wings pale yellowish subhyaline, the stigma unusually pale, only a little darker than the ground-colour: veins brownish black,

the costa paler; obliterative areas at end of *Rs* and across both ends of cell 1st *M*₂. Venation: *Sc* short, *Sc*₁ ending opposite or extending a short distance beyond the origin of *Rs*, *Sc*₂ just before this origin; *Rs* long, more than twice the basal deflection of *R*₄₊₅; basal deflection of *Cu*₁ at or close to the fork of *M*.

Abdominal segments bicolorous, the basal half or more of the segments yellowish, the apical half or less dark brown, the extreme caudal margins of the segments a little paler; the colours of the sternites less contrasting than those of the tergites; ventral dististyles of hypopygium tinged with greenish. Male hypopygium with the ninth tergite having a very gently concave caudal margin. Basistyle with a small setiferous lobe at base on mesal face in addition to the usual large fleshy lobe. Ventral dististyle large and fleshy, the rostrum unusually long and projecting, the two spines borne far out toward the tip which is infuscated beyond them, the spines situated close together at base, gently curved, long and slender, one a very little longer than the other; face of style at base of rostrum with a low tubercle. Dorsal dististyle moderately curved, the long tip acute. Gonapophyses with the mesal lobe long and slender, only gently curved or almost straight, the margins smooth, the apex obtusely rounded and a little infuscated.

Hab. New Zealand (South Island).

Holotype, ♂, Junction Creek, Glenorchy, Otago, altitude 3000 feet, January 5, 1924 (*F. S. Oliver*).

Allotopotype, ♀.

Paratopotypes, 7 ♂ ♀.

"Swept from *Cassinia* scrub."

Dicranomyia arthuriana, sp. n.

General coloration light yellow; basal segment of antenna long, pale, the second segment globular, darkened; wings tinged with yellow, the costal region more suffused; male hypopygium with the rostral spines elongate, placed close together; dorsal dististyle only slightly curved, the apex long and slender.

Male.—Length about 6–6.5 mm.; wing 6–7 mm.

Rostrum yellow, the palpi brown. Antennæ with the basal segment of the scape long, pale; second segment enlarged, subglobular, dark brown; flagellum brown, the segments short-oval. Head yellow.

Thorax light yellow, the centre of the præscutum very indistinctly darker. Halteres pale, the knobs infuscated.

Legs with the coxæ and trochanters yellow; femora brownish yellow; remainder of legs broken. Wings tinged with yellow, the costal region and a seam along vein *Cu* a little more suffused; stigma very pale, barely indicated; veins yellow, those beyond the cord a little more infuscated. Venation: *Sc* short, *Sc*₁ ending a short distance before the origin of *Rs*, *Sc*₂ lacking; *Rs* short, not longer than the basal deflection of *R*₄₊₅ but a little more arcuated; basal deflection of *Cu*₁ at the fork of *M*.

Abdomen yellow. Male hypopygium with the caudal margin of the tergite slightly concave, the median area sparsely setiferous. Basistyles small, the mesal lobe very large. Ventral dististyle large and fleshy, rostrum relatively small, the two spines long and slender, pointed, considerably longer than the apex of the rostrum beyond them, placed very close together. Dorsal dististyle a slightly curved blade, slightly widened beyond mid-length, thence gradually narrowed to the long straight apex. In *D. sulphuralis* and allies this style is strongly curved, sickle-shaped.

Hab. New Zealand (South Island).

Holotype, ♂ alcoholic, Arthur's Pass, Canterbury, altitude 8000 feet, December 28, 1923 (*J. W. Campbell*).

Paratopotype, ♂ alcoholic.

Dicranomyia arthuriana is generally similar to *D. sulphuralis*, Edwards, from which it differs chiefly in genitalic characters.

Molophilus recisus, sp. n.

Male.—Length about 4.5 mm.; wing 6 mm.

Belongs to the *quadrifidus* group and is very closely related to *M. ohakunensis*, Alexander (North Island), from which it differs in genitalic characters.

Basal dististyle of male hypopygium with the flattened lateral blades about intermediate in breadth between *quadrifidus* and *ohakunensis*, the notch between the mesal arms and the lateral blade larger than in *ohakunensis*, but sub-circular in outline; the basal appendage on the mesal face is here reduced to a small chitinated tooth or appressed spine that is sparsely setiferous. In *M. ohakunensis*, this region is very tumid and is densely and conspicuously setiferous.

Hab. New Zealand (South Island).

Holotype, ♂, Woodbaugh Valley, Dunedin, Otago, October 14, 1923 (*W. Geo. Howes*).

Paratopotypes, 2 ♂♂.

Molophilus stewartensis, sp. n.

Closely related to *M. luteipygus*, Alexander, and *M. pictipleura*, Alexander; pleura not striped with dark and light markings; basal dististyle only about one-half the length of the ædeagus.

Male.—Length about 2.5 mm.; wing 3.3 mm.

Most closely allied to *M. pictipleura*, Alexander (South Island). Rostrum and palpi brownish black. Antennæ short, dark brown, the verticils conspicuous. Head grey, the centre of the vertex a little darker.

Pronotum obscure yellow. Mesonotal præscutum light brown, without distinct stripes, the anterior lateral margin yellow; posterior lateral margin of præscutum and of the scutum darker brown; postnotal mediotergite dark brown. Pleura dark brown, the dorso-pleural region obscure yellow; ventral pleurites pruinose in certain lights. Halteres obscure brownish yellow, the base of the stem paler. Legs with the coxæ and trochanters brownish testaceous; femora and tibiæ concolorous, clothed with dark brown setæ; tarsi dark brown, especially the terminal segments. Wings with a faint grey tinge, the veins dark brown. Venation: vein 2nd *A* relatively short, gently sinuate, ending in a very short distance beyond the base of the petiole of cell *M*₃.

Abdomen black, the hypopygium a very little paler, brown. Male hypopygium with the basistyles almost as in *M. luteipygus*, Alexander, the apical beak relatively long and slender. Basal dististyle almost as in *M. pictipleura*, Alexander, very short, relatively stout and straight, dark-coloured, but not blackened, throughout its length and provided with a few weak denticles at the extreme tip. Outer dististyle with the lateral arm not so dilated as in *M. luteipygus*. Ædeagus nearly twice as long as the basal dististyle.

Hab. New Zealand (South Island, Stewart Island).

Holotype, ♂, Half-moon Bay, Stewart Island, altitude 110 feet, November 20, 1923 (*N. J. Jensen*).

Paratopotypes, 3 broken ♂♂; *paratypes*, 2 ♂♂, Glenorchy, Otago, altitude 1200 feet, December 23, 1923 (*F. S. Oliver*); on tutu (*Coriaria*) scrub in open; ♂, Arthur's Pass, Canterbury, altitude 3000 feet, December 28–31, 1923 (*J. W. Campbell*).

Molophilus submorusus, sp. n.

General coloration light reddish brown, the postnotum and thoracic pleura dark brown; head yellow; wings greyish

yellow basally, the apex clearer yellow; male hypopygium with the basal dististyle straight, tapering gradually to the acute apex, the surface with a few scattered denticles.

Male.—Length about 4 mm.; wing 5 mm.

Rostrum and palpi black. Antennæ short, the scapal segments brown, the flagellum pale yellowish or testaceous brown, the outer segments darker; flagellar segments oval. Head yellow, the centre of the vertex subinfuscated.

Pronotum obscure yellow. Mesonotum light reddish brown, the margins clearer; postnotum and pleura dark brown; dorso-pleural membranes obscure yellow. Halteres obscure yellow, the knobs clear light yellow. Legs with the coxæ yellowish brown, darker basally; trochanters obscure brownish yellow; remainder of legs yellow, the terminal tarsal segments infuscated. Wings greyish yellow basally, the apex (beyond the cord) clearer yellow; veins yellow; macrotrichia brown. Venation: petiole of cell R_4 longer than the basal deflection of Cu_1 ; vein 2nd A long, extending to just before the end of the petiole of cell M_3 .

Abdomen dark brown, the hypopygium paler. Male hypopygium with the apical beak of each basistyle moderately stout, heavily chitinized, the tips acute and directed cephalad. Basal dististyle a relatively short straight rod that tapers very gradually to the acute apex, all except the base blackened, the surface and apex with a few scattered subobsolete denticles. *Ædeagus* about one-third longer than the basal dististyle.

Hab. New Zealand (South Island).

Holotype, ♂, Junction Creek, Glenorchy, Otago, altitude 3000 feet, January 5, 1924 (*F. S. Oliver*).

Paratopotype, ♂; *paratypes*, 20 ♂ ♀, mostly alcoholic, Arthur's Pass, Canterbury, December 28, 1923–January 1, 1924 (*J. W. Campbell*).

"Swept from *Cassinia* scrub."—*Oliver*.

Molophilus campbellianus, sp. n.

Male.—Length 3–3.3 mm.; wing 4.2 mm.

Very similar in general appearance to *M. pulcherrimus*, Edwards, differing strikingly in the structure of the male hypopygium.

Mesonotal præscutum with the lateral margins narrowly dark brown, the usual intermediate stripes being developed only on the anterior half of the sclerite. Wings with the brown spot in cell R beneath the origin of R_2 larger, dash-like; white marginal spots larger, those in cells R_4 and R_5

small; anal cells more extensively infuscated. Male hypopygium with the terminal beak of the basistyle slender, black. Basal dististyle very tumid, the base slender, swollen into a subglobular mass, the outer or lateral margin of which is weakly denticulate. Fork of the outer dististyle not so deep as in *M. pulcherrimus*.

Hab. New Zealand (South Island).

Holotype, ♂, Arthur's Pass, Canterbury, altitude 8000 feet, December 28, 1923–January 1, 1924 (*J. W. Campbell*).

Paratopotypes, 5 ♂ ♂, mostly alcoholic.

This handsome crane-fly is named in honour of my friend, Dr. James W. Campbell, to whom the writer is vastly indebted for help and co-operation in making known the fascinating Tipulid fauna of New Zealand.

Molophilus verecundus, sp. n.

General coloration yellow; wings bright yellow, the veins a little darker; male hypopygium with the basal dististyle profoundly bifid beyond mid-length, the arms slender, acute.

Male.—Length about 3 mm.; wing 4–4.2 mm.

Rostrum yellow; palpi dark brown. Antennæ of moderate length; basal segments brownish yellow; flagellar segments pale brown with conspicuous white setæ. Head yellow.

Mesonotal præscutum fulvous yellow, unmarked, the lateral margins narrowly sulphur-yellow; remainder of mesonotum yellowish testaceous. Pleura concolorous. Halteres pale, the knobs yellow. Legs with the coxæ and trochanters yellow; remainder of the legs yellow, gradually passing into brown on the tarsi. Wings with a bright yellow suffusion, the veins darker yellow. Venation: vein 2nd *A* long, slightly variable in its relation to the petiole of cell *M*₂, in some ending opposite mid-length of this vein, in others not so far from the end.

Abdomen pale brownish yellow. Male hypopygium with the basistyle terminating in deep, moderately chitinated blades, the apex acute. Basal dististyle a powerful rod that is profoundly bifid to just beyond mid-length, one arm continued caudad as a direct prolongation of the base but much narrowed and acutely pointed; the other arm is about two-thirds the length of the apical spine, on one style bent gently toward the apex of the terminal spine, on the opposite style bent gently away from it. Outer dististyle with the mesial branch reduced to a short blunt tubercle, the lateral branch being very broad, blade-like.

Hab. New Zealand (South Island).

Holotype, ♂, Arthur's Pass, Canterbury, altitude 3000 feet, December 28, 1923–January 1, 1924 (*J. W. Campbell*).

Paratopotypes, 2 alcoholic ♂♂.

Molophilus verecundus is related to *M. denticulatus*, Alexander.

Tasiocera bituberculata, sp. n.

General coloration dark brown; wings pale brown; cell M_3 about equal in length to its petiole; male hypopygium with the phallosome broad, the caudal margin on either side with a small blunt tubercle.

Male.—Length about 3.2 mm.; wing 4 mm.

Generally similar to *T. tridentata* (Alexander).

Rostrum, palpi, antennæ, and head uniformly dark brown.

Mesonotum dark brown, the pleura similar, the posterior pleurites a little paler. Halteres relatively long, pale, especially at base. Legs with the coxæ and trochanters brown; remainder of legs broken. Wings with a pale brown tinge, the veins slightly darker brown. Venation: Sc_1 ending opposite r , Sc_2 opposite three-fifths the length of Rs , the latter of moderate length, angulated at origin; R_{2+3} a little longer than the basal deflection of R_{4+5} ; inner ends of cells R_3 , R_5 , and M_2 in oblique alignment, the last more basad; cell M_3 about equal to its petiole which is longer than vein Cu_1 beyond it but shorter than the distal section of M_3 ; basal deflection of Cu_1 about two-thirds of its length before the fork of M ; vein *2nd A* short, ending just before the origin of Rs . Wings cuneiformly narrowed, the prearcular cells relatively large.

Abdomen dark brown. Male hypopygium with the dististyles slender, dark-coloured, the setæ small and scattered. Phallosome appearing as a broad transverse mass, the caudal margin obtusely rounded, near mid-distance of each side with a blunt tubercle; ædeagus small, curved.

Hab. New Zealand (South Island).

Holotype, ♂, Glenorchy, Otago, altitude 1500 feet, January 5, 1924 (*F. S. Oliver*).

"On rushes along water-course."

The following New Zealand species, described in the genus *Molophilus* before the male hypopygial characters of the genus *Tasiocera* were known, should be referred to this latter genus: *T. gourlayi* (Alexander), *T. paulula* (Alexander), and *T. tridentata* (Alexander).

Amphineurus (*Amphineurus*) *bicorniger*, sp. n.

Related to *A. (A.) campbelli*, Alexander; antennæ short, the flagellar segments oval; general coloration pale brownish testaceous; male hypopygium with the basal outer dististyle, the basal dististyle, and each gonapophyse bifid at tips.

Male.—Length about 4.5 mm.; wing 4.8 mm.

Related to and resembling *A. (A.) campbelli*, differing conspicuously in the short antennæ and the structure of the male hypopygium.

Rostrum and palpi brown. Antennæ relatively short, brown throughout, the flagellar segments oval, clothed with abundant erect white setæ.

Mesonotum pale brownish testaceous, the median area of the præscutum slightly darker; humeral region brighter. Pleura infuscated, the colour passing on to the lateral margins of the postnotal mediotergite. Halteres dark brown, the base of the stem brighter. Legs with the coxæ and trochanters pale, the former a little infuscated; femora and tibiæ obscure yellow, the colour concealed by abundant dark setæ; tarsi dark brown. Wings brownish subhyaline, the macrotrichia conspicuous, dark brown; veins paler brown. Venation: r a little more than its length beyond the origin of R_2 ; R_{2+3} a little shorter than the basal deflection of R_{4+5} .

Abdomen dark brown; tufts of very long setæ at the posterior lateral angles of the abdominal segments. Male hypopygium of the general type of *A. campbelli*, the basistyles being greatly prolonged beyond the outer dististyle. Basal outer dististyle deeply bifid, the outer style conspicuously dilated at base. Basal dististyle slender, the apex produced into two conspicuous acute horns that are directed from one another in the form of a broad U. Gonapophyses with the subterminal fusion that has begun in *A. (A.) nox*, Alexander, very extensive, the outer angle or bend produced into an acute pale spine, the free or mesal apex slender, the tip gently curved.

Hab. New Zealand (South Island).

Holotype, ♂, Greymouth, Coal Creek Track, Westland, February 13, 1923 (*T. R. Harris*).

Amphineurus (*Amphineurus*) *tumidus breviclavus*, subsp. n.

Male.—Length about 4.6–4.8 mm.; wing 6 mm.

Female.—Length about 4.8 mm.; wing 5.8–6 mm.

Generally similar to typical *tumidus*, Alexander, from which it differs as follows:—

Lateral margins of præscutum not darkened. Pleura less

extensively infuscated, the dorsal anterior part of the post-notal pleurotergite pale. Male hypopygium with the gonapophyses having the stems relatively elongate, the swollen apices correspondingly short and broad, the tips suddenly narrowed into an acute slender spine, the apical margin of the club with abundant long setæ. In the typical form the enlarged club is longer, not much shorter than the basal stem. Basal dististyle shorter than in *tumidus*, the basal half more enlarged, the slender apical portion weakly toothed and setiferous.

Hab. New Zealand (South Island).

Holotype, ♂, Paradise, Otago, altitude 1200 feet, December 30, 1923 (*F. S. Oliver*).

Allotopotype, ♀.

Paratopotypes, 10 ♂ ♀.

"Swept from ferns and other undergrowth in beech forest."

Amphineurus (Amphineurus) operculatus, sp. n.

General coloration grey; antennæ elongate, brownish black; wings light grey with a sparse darker pattern; male hypopygium with a conspicuous flattened plate that appears to represent the ninth tergite; both outer dististyles simple and untoothed.

Male.—Length 4.3 mm.; wing 5.5 mm.

Rostrum and palpi black. Antennæ elongate, brownish black throughout, if bent backward extending at least to the base of the abdomen; flagellar segments elongate-cylindrical to fusiform, with conspicuous erect white setæ. Head dark grey.

Mesonotal præscutum light grey, the median stripe broad, pale brown, constricted opposite the pseudosutural foveæ; lateral stripes obsolete or nearly so; pseudosutural foveæ elongate, black, conspicuous; remainder of mesonotum black, sparsely pruinose. Halteres obscure yellow. Legs with the coxæ and trochanters obscure yellow, the posterior coxæ a little darkened; remainder of legs yellow, covered with dark scales and setæ in un-rubbed specimens, the terminal tarsal segments dark. Wings light grey, the basal region more yellowish grey, the disk with a pale brown pattern, including the stigmal area that is confluent with a conspicuous seam along the cord; a seam at origin of R_s ; outer ends of anal cells extensively darkened; veins yellow, brown in the infuscated areas. Venation: R_s square at origin; R_{2+3} about equal to the basal deflection of R_{4+5} ; cell 1st M_2

elongate-rectangular, gently widened distally, m about one-half the arcuated outer deflection of M_3 ; basal deflection of Cu_1 at the fork of M .

Abdomen dark brown, the tergites indistinctly variegated with paler; basal sternites pale. Male hypopygium with the apices of the basistyles produced caudad into fleshy lobes of moderate length; outer dististyles both simple, the basal one slender, edentate, the outer style broader; basal dististyle a pale, slender, slightly curved rod, the tip acute and slightly darkened. *Ædeagus* slender, straight, blackened. What appears to be the ninth tergite is a large, flattened, conspicuous plate that extends caudad to the outer dististyles, the lateral margins thickened.

Hab. New Zealand (South Island).

Holotype, ♂, Junction Creek, Glenorchy, Otago, altitude 3000 feet, January 5, 1924 (*F. S. Oliver*).

Paratopotype, ♂.

"Swept from *Cassinia* scrub."

Gonomyia (Lipophleps) bispina, sp. n.

Male.—Length about 3.5 mm.; wing 4.5 mm.

Very closely allied to *G. (L.) nigrohalterata*, Edwards, from which it differs chiefly in the structure of the male hypopygium. Brown pleural stripes narrowed behind but connected across the posterior margin of the postnotal mediotergite by a narrow line. Male hypopygium asymmetrical as in the group; one dististyle terminates in two powerful curved spines, the more lateral one longer and larger at base, the mesal or subapical spine with several setæ in its axil, the extreme mesal end of this style terminating in a powerful seta. The distal prolongation of the basistyle of this side is more slender than the one of the opposite side.

Hab. New Zealand (North Island).

Holotype, ♂, Wellington, December 30, 1923 (*H. Hamilton*).

Gonomyia (Lipophleps) oliveri, sp. n.

Male.—Length about 3.5 mm.; wing 4.5–4.6 mm.

Closely related to *G. (L.) nigrohalterata*, Edwards, from which it differs as follows:—

Rostrum orange. Vertex infuscated, the centre of the vertex behind with an orange spot. Knobs of the halteres extensively sulphur-yellow. Wings with R_s about two-thirds the length of R_{2+3} ; inner end of cell 1st M_2 narrowed but

not pointed, the basal deflection of M_{1+2} being preserved. Abdomen dull orange, the sternites brighter-coloured. Male hypopygium with the dististyles asymmetrical, one terminating in a rather long, gently curved spine that is gradually narrowed from the base to the acute tip; apex of the style obtusely rounded.

Hab. New Zealand (South Island).

Holotype, ♂, Junction Creek, Glenorchy, Otago, altitude 3000 feet, January 5, 1924 (*F. S. Oliver*).

Paratopotypes, 4 ♂♂.

"Swept from *Cassinia* scrub."

This handsome little *Gonomyia* is named in honour of the collector, Mr. F. S. Oliver, to whom I am very greatly indebted for numerous Tipuloidea from the vicinity of Lake Wakatipu.

Polymoria argus stewartiae, subsp. n.

Generally similar to the typical *argus* (Hutton), differing as follows:—

Anterior pronotum dark brown. Anterior margin of præscutum narrowly dark brown, the colour continued around the sclerite; scutellum dark grey, the centre dark brown. Dorsal pleural stripe broad, including the base of the fore coxa, broadening out behind, to include the post-notal pleurotergite. Femora with the subterminal yellow annulus broader than the postmedial brown ring. Wings with a pale brown tinge, producing a much darker ground-colour than in the typical form; ocelliform markings virtually all marginal, the spots at m and the fork of M_{1+2} small to subobsolete, in any case not conspicuously ocelliform. Male hypopygium with the outer dististyle bent almost at a right angle at tip, the terminal horn directed mesad, acute, at its base with the style produced caudad into a small, apical, setiferous tubercle. Inner dististyle relatively short, only a little longer than the outer, the apical half flattened and glabrous.

Hab. New Zealand (Stewart Island).

Holotype, ♂, Half-moon Bay, altitude 100 feet, November 17, 1923 (*N. J. Jensen*).

Paratopotypes, 2 ♂♂, December 14, 1923.

The relationships of the above fly to typical *argus* are not quite certain, and it may very possibly prove to be a valid species.

Zelandomyia pallidula, sp. n.

Male.—Length about 4 mm.; wing 4.5–4.7 mm.

Female.—Length about 5 mm.; wing 5.5 mm.

Generally similar to *Z. ruapehuensis* (Alexander).

Size smaller. Mesonotum uniformly pale yellow with a scarcely apparent brown tinge; pleura concolorous, the sternopleurite somewhat infuscated. Wings pale yellow, the veins pale brown. Venation: Sc_1 ending before the fork of R_s ; R_{2+3} longer than the basal deflection of R_{4+5} ; r indistinct; cell M_1 small, not exceeding one-half its petiole; cell 1st M_2 small, the basal deflection of Cu_1 a short distance beyond the fork. Abdomen with the segments uniformly coloured, brownish testaceous, the basal sternites more yellowish. Male hypopygium with the outer dististyle relatively short and stout, the apex darkened and rather obtuse; setiferous tubercles on face of style near mid-length more numerous than in *ruapehuensis* (about six).

Hab. New Zealand (South Island).

Holotype, ♂, Greymouth, Coal Creek Track, February 13, 1923 (*T. R. Harris*).

Allotype, ♀, Ross, Westland, February 23, 1923 (*T. R. Harris*).

Paratypes, ♂, Ross, February 21, 1923; ♂ ♀, Rewanui, Paparoa Range, altitude 600–800 feet, February 15, 1923 (*T. R. Harris*).

Ischnothrix confluenta, sp. n.

General coloration fulvous yellow, the abdomen dark; wings light yellow; cell 1st M_2 open by the atrophy of the outer deflection of vein M_3 , cell 2nd M_2 being a little shorter than its petiole.

Female.—Length about 8 mm.; wing 8.2 mm.

Rostrum and palpi dark brown. Antennæ with the scapal segments fulvous, the flagellum dark brown. Head fulvous brown.

Mesonotum shiny fulvous yellow with vague darker markings, especially on the postnotum. Pleura brownish testaceous, paler ventrally. Halteres pale yellow. Legs with the coxæ and trochanters yellowish testaceous; remainder of the legs yellow, the terminal tarsal segments infuscated. Wings with a strong light yellow tinge, the veins beyond the cord pale yellowish brown, the veins basad of the cord yellow. Venation: R_1 perpendicular to the end of R_{2+3} , pale and

entirely without macrotrichiae, the distance on costa between it and the tip of R_1 a little more than one-half its length; cell 1st M_2 open by the atrophy of the outer deflection of M_3 ; cell 2nd M_2 subequal to or a little shorter than its petiole; basal deflection of Cu_1 a short distance beyond the fork of M .

Abdomen dark brown, the caudal margins of the segments narrowly pale, the subterminal segments nearly black. Ovipositor with the elongate tergal valves slender, straight, the tips gently upcurved.

Hab. New Zealand (North Island).

Holotype, ♀, Wainui State Forest, Wellington, October 21, 1923 (*J. G. Myers*).

Ischnothrix confluenta is readily told by the open cell 1st M_2 , in conjunction with the short cell 2nd M_2 . The other New Zealand species of the genus often have the outer deflection of M_3 very weak to subobsolete, but if this vein was entirely atrophied cell 2nd M_2 would be very deep, at least three to five times as long as its petiole.

Gynoplistia aculeata, sp. n.

Allied to *G. submaculata*, Walker; wing-pattern heavy: outer dististyle of male hypopygium with a conspicuous dilation on mesal face at base.

Male.—Length about 10 mm.; wing 11.5 mm.

Rostrum grey-pruinose, the palpi brownish black. Antennæ 17-segmented, the formula being 2+3+8+4, the longest branch being about four times the length of the segment; scapal segments dark brown, paler beneath; two basal segments of flagellum pale at base and apex, the remainder of the organ black. Head dark grey, the vertex at its narrowest point infuscated.

Pronotum dark, pruinose, the lateral ends of the posterior pronotum brighter. Mesonotal præscutum dark brown with three faintly indicated dark grey stripes, the median one indistinctly bisected; pseudosutural foveæ very large, shiny black; scutum grey, the lobes dark; scutellum and postnotum light grey-pruinose, the latter with a delicately elevated median line. Pleura light grey-pruinose. Halteres obscure yellow, the knobs infuscated. Legs with the coxæ yellow, the outer faces light grey-pruinose; trochanters obscure yellow; femora dark brown, their bases broadly yellowish, each femur with a conspicuous yellow ring more than its length from the tip, the dark apex a little paler near the articulation; tibiæ brown, the tips dark brown; tarsi black. Wings subhyaline, the base and costal region yellowish; a

heavy brown pattern, distributed as follows: stigma oval, dark brown; a circular brown spot at origin of *Rs*; a broad brown seam along the cord, completely traversing the wing; outer end of cell 1st *M*₂ more narrowly seamed; wing-tip broadly infuscated; veins *M* and *Cu* and the veins issuing from cell 1st *M*₂ seamed with brown; a conspicuous brown seam along vein 1st *A*, on the basal two-thirds lying in cell *Cu*, on the outer third lying in cell 1st *A*; veins yellow, a little darker in the infuscated areas. Venation: *Sc*₁ ending opposite the fork of *Rs*, *Sc*₂ longer than *Sc*₁; *Rs* long, angulated and weakly spurred at origin; *R*₂₊₃ longer than the basal deflection of *Cu*₁; cell *M*₁ about one-half longer than its petiole; basal deflection of *Cu*₁ near two-thirds the length of the cell.

Abdomen brown, the dorsal median area broadly dark grey; sternites dark brown, their bases a little paler. Male hypopygium with the ninth tergite densely setiferous, terminating in a long aculeate median process; hypopygium relatively large, reddish; basistyles relatively stout, the mesal face of each near apex with a conspicuous flattened lobe that is clothed with long yellow setæ; opposite side of basistyle with another low setiferous tubercle; no chitinated interbasal process. Outer dististyle depressed-flattened at apex, on outer face at base of depressed area with a long, slender, acute spine; base of style on mesal face dilated into a conspicuous flattened spinous lobe. Inner dististyle slender. *Aedeagus* relatively stout, the apex subtended on either side by a small flattened blade. No evident chitinated gonapophyses.

Hab. New Zealand (South Island).

Holotype, ♂, Paradise, Otago, altitude 1200 feet, December 30, 1923 (*F. S. Oliver*).

Gynoplistia dilatata, sp. n.

General coloration shiny coal-black, including the head; wings faintly tinged with brown, with a nearly complete, darker brown fascia at the origin of *Rs*; male hypopygium with the gonopophyses sublyriform, the tips of each expanded into irregular blades.

Male.—Length about 5 mm.; wing 6 mm.

Rostrum dull black, the palpi brownish black. Antennæ broken beyond the scape, the latter black. Head shiny coal-black.

Pronotum and mesonotum shiny coal-black, the median area of the scutum and the scutellum dusted with

grey. Pleura shiny coal-black, the dorso-pleural region duller; pteropleurite, hypoepimeron, meron, and metapleural katapisternum with a dense silvery pubescence. Halteres obscure yellow, the knobs dark brown. Legs with the coxæ dark brown, sparsely pruinose, the fore coxæ a little darker; trochanters obscure brownish yellow; only one leg (posterior) remains; femora brownish yellow, the tips rather broadly and conspicuously blackened; tibiæ brown, the tips narrowly blackened; tarsi broken. Wings with a faint brown tinge; costal region a very little darker; dark brown markings, distributed as follows: a barely interrupted band at the level of the origin of *Rs*, including large areas at origin of *Rs*, in cell *M*, and in cell 1st *A*; stigma large, oval, confluent with a large area on the anterior cord, chiefly in the base of cell *R*₃; remainder of cord and outer end of cell 1st *M*₂ narrowly seamed with brown; veins dark brown. Venation: *Sc*₂ longer than *Sc*₁, extending to just beyond the edge of *Rs*; *r* and tip of *R*₁ subobsolete; *Rs* angulated and spurred at origin; *R*₂ sinuous; cell *M*₁ shorter than its petiole; basal deflection of *Cu*₁ beyond mid-length of cell 1st *M*₂.

Abdomen black, the centres of the sternites somewhat paler. Male hypopygium with the basistyles stout, the mesal face produced into various lobes, the longest a flattened finger-like lobe directed mesad and slightly cephalad; apex of style produced caudad and mesad into a conspicuous lobe of peculiar shape, the apex truncate, the surface with a few long setæ. Outer dististyle a little longer, the apical fourth suddenly narrowed and gently curved; inner style very broadly dilated at base, near mid-length suddenly narrowed, very gradually and evenly expanded into a flattened obtuse blade, the surface with a few large and many smaller setæ. Gonapophyses taken together appearing sublyriform, the apex of each expanded into an irregular blade. *Ædeagus* small.

Hab. New Zealand (Stewart Island).

Holotype, ♂, Half-moon Bay, altitude 110 feet, November 20, 1923 (*N. J. Jensen*).

MACROMASTIX, Osten-Sacken.

The extensive genus *Macromastix* is almost, if not quite, Antipodal in its distribution and reaches its maximum of species in New Zealand, to the virtual exclusion of other Tipuline genera. In this complex of species there occurs three groups of forms that are so distinct from other members

of the genus that their characters seem to warrant the erection of new subgeneric groups to include them. These new groups, which are proposed herewith, include all the familiar orange and black and the green Tipulidæ so characteristic of the New Zealand fauna.

AUBOTIPULA, subgen. nov.

Characters as in the typical subgenus. Antennæ short in both sexes, 12-segmented in the *tenera* group, 13-segmented in the other species. Wings with *Rs* nearly straight, elongate, fully one-half longer than R_{2+3} , shortest in the *tenera* group; *r* present, except in *M. aperta*; cell M_1 always present. Ovipositor with the valves short and fleshy. Coloration orange or orange-yellow, variegated with black.

Type of subgenus, *Macromastix flavoscapus*, Alexander (Maorian Subregion).

This group of orange and black *Macromastix* is confined to New Zealand, where it includes the following additional species: *M. aperta*, Edwards, *M. atrofava*, Alexander, *M. auroatra*, Edwards, *M. brevitarsis*, Edwards, *M. bivittata*, Edwards, *M. clara* (Kirby), *M. dux* (Kirby), *M. ferruginosa*, Edwards, and the variety *ruapehuensis*, Alexander, *M. occlusa*, Edwards, *M. orion* (Hudson), *M. subtenera*, Alexander, and *M. tenera* (Hutton).

CHLOROTIPULA, subgen. nov.

Characters as in the typical subgenus. Antennæ short in both sexes, 13-segmented. Wings with *Rs* subequal to or shorter than R_{2+3} ; R_3 fully three to four times R_2 alone and extended strongly towards the wing-apex, so cell R_2 at wing-margin is much wider than cell R_3 . Ovipositor with the valves slender and pointed but not heavily chitinized, the surface clothed with delicate erect setæ. Coloration green, except in *M. elongata*.

Type of the subgenus, *Macromastix viridis* (Walker) (Maorian Subregion).

This group of green *Macromastix* is confined to New Zealand, where it includes the following additional species: *M. albistigma*, Edwards, *M. holochlora* (Nowicki) and the variety *angustior*, Alexander, and *M. virescens*, Edwards. Despite its lack of green colour, *M. elongata*, Edwards, is almost certainly a member of this group. On the other hand, the small species of *Macromastix* showing green body tints (*M. campbelli*, Alexander, *M. pallidistigma*, Alexander, and *M. tapleyi*, Alexander) are better referred to the typical subgenus.

MAORITIPULA, subgen. nov.

Characters as in the typical subgenus. Antennæ short in both sexes, 12-segmented. Wings with *Rs* elongate, fully twice R_{2+3} , arcuated at origin; a conspicuous spur near mid-length of vein *M*, jutting caudad and distad into cell *M*.

Type of the subgenus, *Macromastix maori*, Alexander (Maorian Subregion).

The species described as *Tipula nebulosa*, Hudson (1920), likewise belongs here. Unfortunately the name is homonymous with *Tipula nebulosa*, Bellardi (1859), and is here renamed *Macromastix (Maoritipula) hudsoni*, new name.

XXXV.—Some new or noteworthy Madagascar and African *Heterocera*. By Lord ROTHSCHILD, F.R.S.

Amatidæ.

(1) *Thyrosticta octopunctata*, sp. n.

♀. Antennæ black; frons orange; vertex brown; collar and front edge of patagia orange, rest of patagia and tegulæ chocolate-brown, thorax orange; abdomen orange-brown.

Fore wing chocolate-brown, base of costal area orange; a buff spot on vein 1 below cell, a creamy-white spot in cell, and a similar one on veins 3 and 7. Hind wing orange with black margin.

♂ similar to ♀, but smaller and only basal $\frac{1}{2}$ of hind wing orange, the rest of hind wing being thickly clothed with buffish-grey androconial scales.

Length of fore wing, ♂ 8, ♀ 11 mm.; expanse, ♂ 18, ♀ 24 mm.

Hab. 1 ♂, 1 ♀, Diego Suarez, Feb. 1917 (*G. Melou*).

♀ type.

(2) *Thyrosticta obliquipuncta*, sp. n.

♂. Antennæ black; frons dull orange-yellow, rest of head and thorax dark brown; abdomen dull orange.

Fore wing dark brown, with a large white spot in cell and one obliquely below it on vein 2. Hind wing dull orange-yellow, with black margin broader than in preceding species.

♀ similar to ♂, but has extra white spot on vein 6 and occasionally also on vein 1.

Length of fore wing, ♂ 9, ♀ 10 mm.; expanse, ♂ 22, ♀ 24 mm.

Hab. 2 ♂ ♂, 3 ♀ ♀, Diego Suarez, Aug.-Sept. 1917 (*G. Melou coll.*).

Lithosidæ.

LITHOSIINÆ.

(3) *Ilema rectiscissa*, sp. n.

♂. Similar to *I. funeralis*, Kenr., but larger and with inner edge of the black outer portion of fore wings cut quite straight, NOT concave, and produced along inner margin. The black outer portion of hind wing has the inner edge also much straighter than in *funeralis*. The whole thorax and abdomen is crimson, only a black dorsal patch on the two basal segments of the abdomen and lateral ones on the third segments, whereas in *funeralis* the whole abdomen is black, with anal tuft and a lateral spot on second segment red. The basal half of fore wing is not nearly so strongly suffused with crimson, only the costa and base of wing being entirely crimson, whereas in *funeralis* the whole basal half is crimson.

Length of fore wing 16 mm.; expanse 36 mm.

Hab. 1 ♂, Diego Suarez, April 1917 (*G. Melou coll.*).

(4) *Ilema bitincta*, sp. n.

This beautiful species also belongs to the *funeralis* group, and appears to have two rather different-looking broods in the year.

♂, gen. vern., *bitincta*. Antennæ black-brown; head and thorax bright crimson, a blackish tuft of hair on each side at juncture with abdomen; abdomen paler, more orange-crimson.

Fore wing crimson on basal $\frac{2}{3}$, outer $\frac{1}{3}$ black; a median broad black band sharply constricted basad from median to costa. Hind wing: basal half orange-crimson, outer half black running up the abdominal margin.

♂, gen. æst., *sordidescens* differs from the spring brood in having the head, thorax, and abdomen entirely suffused with brown, and the crimson of the fore wings dirty dull brown, and the black median band broader or closer to black outer portion of wing. Crimson basal portion of hind wing of spring brood replaced by brownish or rufous orange.

Length of fore wing 10 mm.; expanse 23 mm.

Hab. Diego Suarez, April & Aug.-Sept. 1917 (*G. Melou coll.*).

2 ♂ ♂, gen. æst., *sordidescens*; 2 ♂ ♂, gen. vern., *bitincta*.

(5) *Ilema kingdoni conspicua*, subsp. n.

♂ ♀. Considerably smaller than *M. kingdoni*, Butl.—the ♀ = the ♂ of that form only in size. The ♂ ♂ also in some cases have darker buff hind wings.

Expanse, ♂ 34–40 mm., ♀ 46 mm.

(6) *Ilema contempta*, sp. n.

♂. Antennæ dark brown; head and thorax greyish cinnamon-buff; abdomen yellowish mouse-grey, anal tuft golden-buff.

Fore wing: basal $\frac{2}{3}$ greyish-buffy cinnamon, outer $\frac{2}{3}$ sprinkled with brownish-mauve scales, especially along veins. Hind wings clear yellowish buff.

♀ similar, but fore wings devoid of sprinkling.

Length of fore wing 11.5 mm.; expanse 26 mm.

(7) *Cyana* (*Chionema*, auct. plur.) *puella postflavida*, subsp. n.

Differs from *p. puella* in the less sinuate postmedian red band and in having yellowish buff, NOT pink, hind wings.

Hab. 1 ♂, 1 ♀, Diego Suarez, April–May 1917 (*G. Melou coll.*).

(8) *Siccia humilis*, sp. n.

♂ ♀. Antennæ greyish white; head, patagia, and tegulæ greyish white; a black dot on vertex; rest of thorax greyish white with seven black dots; abdomen pale grey, anal tuft white.

Fore wing greyish white, two black dots near base, a somewhat broken antemedian irregular black band, followed in ♂ by black dot; an oblique median irregular expanding sooty band; a postmedian zigzag black band, broken and indistinct on and below vein 2, double in ♂; a terminal row of black dots. Hind wings grey, fringe white.

Length of fore wing 9 mm.; expanse 21 mm.

Hab. 2 ♂ ♂, 1 ♀, Diego Suarez, July–Aug. 1917 (*G. Melou*).

♀ type.

AECTINÆ.(9) *Phryganopteryx strigillata*, Saalm.

The ♂ of this interesting species has not yet been described.

♂. Differs from ♀ in the shorter fore wings and broader hind wings. Ground-colour of fore wings sooty-brownish slate-colour, not brown wood-grey as in ♀; all dark streaks absent or obsolescent, except on nervures in outer $\frac{1}{3}$ of wings; black streak from near end of cell more than twice as long as in ♀ and wider; the black cellular stigma is also larger. The hind wings are the same colour as in the ♀, but have the costal $\frac{2}{3}$ less densely scaled. The yellow basal spot on fore wing is larger and more conspicuous, and the dorsal black patch on anal segment of the abdomen in the ♀ is wanting.

2 ♂♂, 1 ♀, Diego Suarez, Feb.-April 1917 (*G. Melou coll.*).

(10) *Phryganopteryx feminina*, sp. n.

♂. Resembles ♀ of *strigillata* in having all the streaks strongly marked and in having the long narrow fore and hind wing.

♂. Differs at first sight from ♂ of *strigillata* in the very dark unspotted thorax, in the basal three segments (NOT two) of the abdomen being sooty-black, in the narrow dark brown heavily streaked and striated fore wings, and in the black hind wings.

♀. Differs from ♀ of *strigillata* in the thorax being more uniform dark brown, in the three (NOT two) first segments of abdomen being dark brown, in the wings being still narrower, and the fore wings with the streaks and striations larger and much stronger, and by the terminal row of wedge-shaped black spots on fore wing.

Length of fore wing, ♂ 30 mm., ♀ 31 mm.; expanse, ♂ 66 mm., ♀ 68 mm.

Hab. 2 ♂♂, 1 ♀, "Madagascar" and Diego Suarez.

♂ type, "Madagascar."

(11) *Phryganopteryx saalmülleri*, sp. n.

♂ ♀. Antennæ dark brown, basal joints black; head mouse-grey, two red spots on vertex; thorax mouse-grey, patagia with central black dot, behind patagia a red spot; tegulæ with two black streaks, a black central spot, and two lateral red ones at end of thorax; abdomen—basal segment yellowish grey, rest of abdomen scarlet, a dorsal row of black dots; anal tuft orange-buff.

Fore wings wood-grey, nervures more whitish, on the nervures a series of black spots in basal half and striæ in distal half; five black marks in costal region and heavier black

striæ on median fold; a black oblong patch at end of, and a black stigmatic dot in, cell. Hind wing: basal $\frac{2}{3}$ greyish buff, outer $\frac{1}{3}$ brownish wood-grey. ♀ only differs in the intra-neural terminal row of black dots on fore wing being smaller and the hind wing paler and more uniform in colour.

Length of fore wing, ♂ 19–21 mm., ♀ 21 mm.; expanse, ♂ 22–24 mm., ♀ 24 mm.

♂ type.

Hab. 6 ♂♂, 1 ♀, March–Sept. 1917; Diego Saurez (*G. Melou coll.*).

Noctuidæ.

AGROTINÆ.

(12) *Chloridea posttriphæna*, sp. n.

♂ ♀. Antennæ dark brown; palpi pinkish rufous; head and thorax olive-grey; abdomen dark orange-buff dorsally, white laterally.

Fore wing olive-grey irrorated with slightly darker olive clouding, an oblique darker olive postmedian band pinkish buff on inner side (basad), terminal line rufous. Hind wing bright orange-buff with very broad subterminal black band.

Length of fore wing 13 mm.; expanse 31 mm.

Hab. 2 ♂♂, 7 ♀♀, Diego Suarez, April–June 1917 (*G. Melou*).

♀ type.

(13) *Adisura malagassica*, sp. n.

This insect is dimorphic, appearing either with the fore wings pyrethrum rose-colour suffused with buffy-yellow on the disc or with fore wings entirely isabelline buff thinly powdered with black scales.

♂ ♀, form. dimorph. *malagassica*. Antennæ brown, whitish towards base; head greyish white; thorax pinkish grey; abdomen pale stramineous buff.

Fore wing pyrethrum rose-colour, edge of costa white, disc in outer $\frac{2}{3}$ of wing suffused irregularly with pale buffy yellow. Hind wing semivitreous sericeous cream-colour with a golden gloss, outer $\frac{1}{3}$ of wing suffused with sooty-brown, forming a more or less obsolete dark marginal band.

♂ ♀, form. dimorph. *anerythra* differs from the typical form in the fore wings being entirely isabelline buff with no trace of rose-colour. The ♀ has the hind wing with a very distinct brownish outer $\frac{1}{3}$ of hind wing.

Length of fore wing, ♂ 12 mm., ♀ 12 mm.; expanse 27 mm.

Hab. 1 ♂, 1 ♀, f. d. *malagassica*; 1 ♂, 1 ♀, f. d. *anerythra*. Diego Suarez, May 1917 (*G. Melou coll.*).

ZERYNTHINÆ (*Acronyctinæ*).

(14) *Eriopus violascens*, sp. n.

Distinguished from most of the other species by the suppression or obsolescence of most of the characteristic pattern of the fore wing, by the large mauve or lavender ovate patch obliquely beyond cell, and by the two chocolate patches on termen.

♂. Antennæ dark brown; palpi and head brownish wood-grey; thorax dark umber-brown freckled with grey, hind part pale pinkish cinnamon; abdomen sooty slate-brown, anal tuft dirty buff.

Fore wing dark umber-brown, base variegated somewhat with brownish buff, an antemedian irregular buffish band with central brown line, an oblique lavender-mauve egg-shaped patch beyond this band reaching from costa to vein 4, an angled margino-submarginal buffy-brown band from which projects a triangle of pale lines to the ovate mauve patch and on which near margin are two dark brown patches.

Hind wings dark greyish brown, fringe chequered with pale grey.

Length of fore wing 10 mm.; expanse 23 mm.

Hab. 1 ♂, Diego Suarez, July 1917 (*G. Melou coll.*).

1 ♂, —?

(15) *Eriopus rufulus*, sp. n.

♂. Antennæ pale brown; head and thorax pale buffish wood-brown, the latter somewhat freckled with rufous-brown; abdomen sooty wood-grey, edges of segments and anal tuft greyish cream-buff.

Fore wing rusty-brown with a median dark shadow-band; subbasal, antemedian, and postmedian buff sinuate crenulate bands in which (or along which) are dark brown lines, at end of cell and beyond postmedian band are large buff patches.

Hind wing sooty brown-grey, fringe dirty grey-buff.

Length of fore wing 11 mm.; expanse 25 mm.

Hab. 1 ♂, Diego Suarez, Feb. 1917 (*G. Melou coll.*).

(16) *Acronycta pseudobamra*, sp. n.

This fine new species has completely the facies of the Noctuid genus *Bamra*.

♂. Antennæ honey-brown, basal $\frac{4}{5}$ pectinate, pectinations gradually decreasing distad; head and patagia chocolate-brown; rest of thorax silvery lichenous-grey; abdomen light coffee-brown washed with grey, anal tuft cinnamon.

Fore wing lichen-grey slightly washed with pale green and with somewhat indistinct darker more brownish transverse lines; on the basal $\frac{1}{4}$ of costa three chocolate spots, the central one largest; a white angled discocellular line; from costa above discocellulars runs a broad black band to median vein, where it is abruptly angled, running along vein 4 to termen; between the three costal spots and the black band the costal area is pale buffy cinnamon, and beyond the black band the $\frac{2}{3}$ of area between vein 4 and termen nearest black band is cinnamon-colour, enclosing three short darker lines, the outer $\frac{1}{4}$ grey. Hind wing semivitreous-white, above vein 6 and fringe cinnamon-brown.

Length of fore wing 21 mm.; expanse 48 mm.

Hab. 1 ♂, Diego Suarez, Feb. 1917 (*G. Melou coll.*).

(17) *Acronycta mediocritta*, sp. n.

♂. Antennæ brown-grey; head and thorax ash-grey, vertex darker; abdomen brownish wood-grey.

Fore wing ash-grey, reniform and large area beyond down to vein 3 washed with pale brown, a broad black stripe from base along median fold to $\frac{1}{3}$ the length of the wing, a black streak from it to cell, the disc of wing with several darker grey and sooty-grey, more or less indistinct, angled or crenulate, transverse lines; a heavy black band along vein 2 to termen.

Hind wing pale brownish grey, more or less washed with creamy-white.

Length of fore wing 17–20 mm.; expanse 22–25 mm.

Hab. 2 ♂♂, Diego Suarez, March and Aug. 1917 (*G. Melou coll.*).

(18) *Cetola phaleroides*, sp. n.

Sir George Hampson has placed the genus *Cetola* in the Zerynthinæ (Acronyctinæ), but the neuration is decidedly more Noctuid in type.

This is the largest and brightest species yet found, and the pattern is the most contrasted of them all.

♂. Antennæ golden-brown, pectinated, the pectinations diminishing in length to tip; palpi and head cinnamon; thorax bluish ash-grey, edges of patagia, tegulæ, and centre of thorax cinnamon; abdomen pale buffish cinnamon, two large dorsal tufts on basal two segments cinnamon-rufous.

Fore wing from median nervure to inner margin, and within this lower half from termen to within $\frac{1}{3}$ of base brown; upper half of wing above median from base to within $\frac{2}{3}$ of apex obliquely bluish or lavender lichen-grey, this grey beyond reniform running down in an ovate projection into the brown lower half; outer $\frac{1}{4}$ above vein 4 buff, striated irregularly with thin striæ of rufous-brown and giving an appearance of the apical yellow patch in *Phalera bucephala*. Hind wing sericeous-white, somewhat opalescent, cellular stigma sooty-brown, abdominal area and fringe pale cinnamon.

Length of fore wing 19–21 mm.; expanse 43–47 mm.

Hab. Diego Suarez, March and May 1917 (*G. Melou coll.*).
2 ♂♂ type, May 26.

(19) *Eudryas madagascariensis*, sp. n.

The genus *Eudryas* has hitherto been known as exclusively American. Sir George Hampson has placed the genus *Eudryas* and a number of other genera at the end of the Zerynthinæ, but both Dr. Jordan and I consider they have more affinities with the Agaristidæ. I leave this new species at present where Sir George Hampson put it, because this whole section will have to be revised, which would require a volume to do thoroughly.

♀. Antennæ cylindrical, brown; head buff, frons with black and white spots; patagia golden-buff, rest of thorax mixed white and pale grey, buff at juncture with abdomen; abdomen golden orange-buff.

Fore wing whitish grey with several irregular sinuate indistinct pale olive-yellow or yellowish-olive transverse lines and markings, a large maroon oval patch above and a small triangle of same colour below vein 1; a broad sub-marginal lavender-purple band, somewhat sinuate and narrowing to near tornus, basad this band is edged by two broad lines, one of maroon-red and the inmost of olive-yellow, distad this band is edged broadly with maroon-red from costa to vein 6, between veins 3 and 4, and has a maroon spot above vein 1; termen olive-yellow. Hind wing bright buffish golden-yellow, nervures darker.

Length of fore wing 18 mm.; expanse 41 mm.

Hab. 1 ♀, Diego Suarez, Dec. 1916 (*G. Melou coll.*).

The following three species are out of place :—

(20) *Cirrodes rosaceus*, sp. n.

♂. Antennæ honey-brown; head, thorax, and abdomen buff.

Fore wing: basal $\frac{2}{3}$ magenta-crimson, the distal edge of this colour-area sharply angled beyond cell, from the point of angle to costa a white patch; outer $\frac{1}{3}$ buff washed with mauve-crimson and white towards apex of wing, and having deep intranervular folds coloured magenta-crimson. Hind wing silky cream-colour, outer $\frac{1}{3}$ strongly suffused with buff.

Length of fore wing 8 mm.; expanse 18 mm.

Hab. 1 ♂, Waute Merehan, Abyssinia, May 1901 (*C. von Erlanger*).

(21) *Carcharoda erlangeri*, sp. n.

♀. Antennæ apparently yellow tinged with mauve; head and thorax orange-buff washed with mauve; abdomen dull orange-buff.

Fore wings greyish white, completely saturated mauve; a white postdiscal very thin line angled and curved at vein 7, a similar subterminal white line NOT angled and curved; between these two white lines the mauve is most developed, and between veins 5 and 6 and 8 and costa are two patches of bright mauve, fringe olive-buff. Hind wing golden orange-buff.

Length of fore wing 9 mm.; expanse 20 mm.

Hab. Waute Merehan, Abyssinia, May 1901 (*C. von Erlanger*).

(22) *Carcharoda splendida*, sp. n.

♂ ♀. Antennæ amber-brown; head greyish white, thorax dirty greyish buff, a large tuft on hindmost portion cinnamon and rufous mixed; abdomen buffy wood-brown, a tuft on basal segment rusty rufous-brown.

Fore wing brownish mauve, striated with short streaks of olivaceous amber-brown; a large stigma at end of cell whitish, with brownish-mauve ring and small dots within; base of costal area greenish, basal half of cell and below median to inner margin dull pea-green, followed below median and along vein 2 by an oblique quadrate olive patch; on vein 1 near base a large mauve patch; fringe and terminal lines olive apple-green. Hind wings sooty wood-grey; fringe greenish buff.

Length of fore wing, ♂ 9–12 mm., ♀ 16 mm.; expanse, ♂ 21–28 mm., ♀ 38 mm.

Hab. 2 ♂♂, 1 ♀, Diego Suarez, Jan.–March 1917 (*G. Melou coll.*).

♀ type.

(23) *Paratuertia abrupta*, sp. n.

♂ ♀. Differs from *featheri*, Fawc., in having the fore wings blunter, much less produced, almost square, in having the band above the silvery band bright olive-green not black-brown, in the postdiscal band being absent, and in having the hind wings paler.

♂ type.

Hab. 1 ♂, 6 ♀♀, Kibwesi, Nov. 1916; 1 ♀, Mason-goleni, Nov. 1918, British East Africa (*W. Feather coll.*).

(24) *Leucoris latifascia*, sp. n.

♂ ♀. Differs from *lepta*, Fawc., in the much wider black apex to fore wing, and in the ♀ the wider black termen to hind wing.

Length of fore wing, ♂ 14 mm., ♀ 18 mm.; expanse, ♂ 31 mm., ♀ 39 mm.

Hab. 6 ♂♂, 1 ♀, Kibwesi, British East Africa, Nov.–Dec. 1916, Jan. 1917.

ERASTRIINÆ.

(25) *Eublemma insignifica*, sp. n.

♂. Antennæ whitish; head, thorax, and abdomen greyish white.

Fore wing whitish, strongly suffused with olive-grey on distal $\frac{1}{3}$, basal $\frac{1}{3}$ apparently suffused with yellowish buff; postmedian and postdiscal bands brownish amber-yellow, edged distad with white. Hind wings white, basal $\frac{2}{3}$ slightly powdered with rufous, outer $\frac{1}{3}$ more thickly suffused with brown-grey, the ground-colour separating the two areas in the guise of a sinuate white line.

Length of fore wing 9 mm.; expanse 20 mm.

(26) *Eublemma tephroclytioides*, sp. n.

♀. Antennæ—basal $\frac{1}{3}$ ringed light and dark grey, distal $\frac{2}{3}$ brown; head and patagia dirty ash-grey, rest of thorax pale dull pink; abdomen brownish ash-grey.

Fore wing dull pink, basal $\frac{2}{3}$ black and blue-grey mixed,

the basal portion of this area below median white, outer $\frac{3}{8}$ below vein 2 black and blue-grey mixed, continuing round termen to above vein 5, where it widens to $\frac{3}{8}$ of the wing to costa; in central area of disc are two black marks on costa and a number of irregular, darker, more brown-pink lines crossing disc. Hind wing mouse-grey, some black freckling running into wing from termen in abdominal $\frac{1}{3}$ of wing and some marginal irregular pinkish marks in central $\frac{1}{3}$ of wing.

Length of fore wing 9 mm.; expanse 20 mm.

Hab. 1 ♀, Diego Suarez, April 1917 (*G. Melou coll.*).

(27) *Eublemma subrufula*, sp. n.

♀. Antennæ pale brown; head and thorax pinkish whitey grey; abdomen dull rusty-buff.

Fore wing dirty white, densely speckled and saturated with reddish mauve; an irregular indistinct zigzag antemedian pale olive-brown line, a broader slightly oblique median band of same colour outwardly edged with white; thin white post-discal and terminal lines joined at apex of wing; between postdiscal and median lines is an indistinct zigzag olive line; a subapical black dot. Hind wings dull yellowish rufous.

Length of fore wing 8 mm.; expanse 18 mm.

Hab. 1 ♀, Diego Suarez, April 1917 (*G. Melou coll.*).

(28) *Eublemma rufocastanea*, sp. n.

♂. Antennæ chestnut-brown; head dark yellowish mouse-grey; thorax chestnut mauve-brown; abdomen yellowish chestnut.

Fore wing chestnut-pink; subbasal, antemedian, median, and subterminal pale yellow minute zigzag lines, the median one double round reniform stigma; between the antemedian and median line the area is irregularly clouded and patched with chocolate-brown, a chocolate-brown patch distad of reniform, a chocolate terminal line edged outside with yellow. Hind wing pinkish chestnut.

Length of fore wing 8 mm.; expanse 18 mm.

Hab. 2 ♂♂, Diego Suarez, Feb. and April 1917 (*G. Melou coll.*).

Type, Feb.

(29) *Eublemma postrufa*, sp. n.

♂. Antennæ olive-grey ringed with black; head and thorax pale olive-grey; abdomen—two basal segments pale olive-grey, remaining segments maroon, cinnamon-blackish dorsally.

Fore wing : basal $\frac{1}{3}$ pale olive-grey, a sooty spot near base below median ; distal $\frac{2}{3}$ maroon-chocolate, a broad band of deeper maroon-chocolate bordering basal $\frac{1}{3}$ and a subapical patch of similar colour. Hind wing bright rufous.

Length of fore wing 8 mm.; expanse 18 mm.

Hab. 1 ♂, Diego Suarez, March 1917 (*G. Melou coll.*).

XXXVI.—Notes on *Lophoceros jacksoni*, Grant, and *L. deckeni* (Cab.). By Lord ROTHESCHILD, F.R.S., Ph.D.

IN 1905 Baron Carlo von Erlanger (in J. f. O. p. 441) declared that *L. jacksoni* was the young of *L. deckeni*, as the spotted wings were young characters—this being proved by two young birds taken from the nest by himself at Gurra in Abyssinia. The Tring Museum possesses a large series of *L. deckeni* from Abyssinia, East Africa (Revoil), Kenya Colony, Somaliland, and Uganda.

Both Claude Grant and van Someren have already pointed out that these two birds are good species ; but they, as well as Mr. P. L. Sclater in the first part of the 'Systema Avium,' have fallen into an error, though quite unconsciously. They have given separate faunal areas to the two species, no doubt founded on the series they had for comparison. At Tring, however, we have two adult specimens collected by a Frenchman, both from the same locality in East Africa, showing the characteristic bill-differences given by C. Grant, and also showing the spotted and unspotted wings respectively. This, I think, conclusively proves that these two birds are distinct species. Moreover, I have several young birds (one collected by Oscar Neumann at Nkurame Pangani) which show more or less spotted wings, but the spots are dark buff or brownish, NOT white as in adult *L. jacksoni*. It appears to me, therefore, that the true status of these birds is as follows :—*Lophoceros deckeni* is a species with a very wide distribution, ranging from Abyssinia and Somaliland in the north to the Kenya and Tanganyika Provinces in the south, and that a second species—*L. jacksoni*—occurs alongside of it in its more southern range. In a restricted part of Uganda, moreover, the latter species—*L. jacksoni*—occurs alone.

XXXVII.—*The Phylogeny of the Cirripedia.*

By THOMAS H. WITHERS, F.G.S.

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I.

DR. R. RUEDEMANN has discovered in the Upper Ordovician rocks (Utica Shale and Trenton Limestone) of North America certain fossils which he considers to be Cirripedes. In a preliminary paper (1918, Proc. Nat. Acad. Sci. Washington, iv. pp. 382-384) he named these fossils *Eobalanus*, and not only derived the recent sessile barnacles (Balanidæ) from *Eobalanus*, but in turn derived *Eobalanus* from the Phyllocarida. These views received very trenchant criticism at the hands of Dr. Calman (1919, Geol. Mag. (vi.), vi. pp. 278-279), mainly, however, from the general view of the derivation of the Cirripedia from the Phyllocarida. Dr. Ruedemann has since published (1924, Bull. N.Y. State Museum, No. 251, pp. 93-104, pls. i., ii) a more complete account of these fossils.

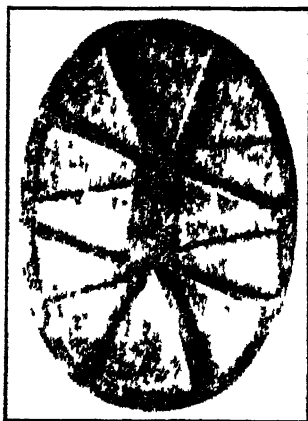
Now that we have a full account of *Eobalanus*, it is important to all who are interested in the question of the phylogeny of the Cirripedes to examine very closely the evidence on which this Palæozoic fossil is referred to that group.

Fortunately for me, Dr. Ruedemann wished to have my opinion on these fossils, and he very kindly arranged with the authorities of the New York State Museum and the American Museum of Natural History for the original specimens to be sent to me for examination. For this consideration I am much indebted to him and to the authorities of those Museums.

Briefly, Dr. Ruedemann's views on these fossils are as follows:—He draws attention to the fact that some Phyllo-pods (*Apus*) are wont to swim on their backs, and he imagines that some Phyllocarid, like the Devonian *Rhino-caris*, became attached by its head and back. The head and back thus being protected by attachment, and the ventral side open to attack, the carapace valves separated along the hinge-line and moved upwards on to the ventral surface, the rostrum and dorsal plate also moving upwards to form the rostrum and carina of barnacles. Stresses at one end or the other caused the splitting up of the plates of the carapace and the formation of the lateralialia. In this way

is formed *Eobalanus*, which has a broadly oval shell, with twelve triangular plates—one at each end comparable to the rostrum and carina of cirripedes, and on each side five triangular lateralia, the middle lateral plate of which is inverted. The opercular plates are supposed not to have been formed.

The four known specimens of *Eobalanus* (*E. informans* and *E. trentonensis*) are situated well forward on the body-chamber of certain Cephalopods (*Geisonoceras*), and the text-fig. is a good representation of the best-preserved specimen of *E. informans* from the Utica Shale. The shell of the Cephalopod is preserved as a thin film, and the structure of the *Eobalanus* cannot be differentiated from it. To my



Eobalanus informans, Ruedemann. Holotype, $\times 5$ diam.
Reproduced from Ruedemann, 1924, pl. ii. fig. 1.

mind, therefore, these fossils suggest that they are merely the impress on the Cephalopod shell of some organism. In any case, it can not be said from these specimens that the parts of the fossil represent separate plates. Dr. Ruedemann's view is that the parts (compartments) were fused only at the base, and that the interspaces were occupied by connecting chitinous bands. All the specimens are completely flattened, and in the specimen (see text-fig.) the parts are apparently not in the least displaced, nor do they overlap in any way. It seems to me almost impossible for any shell with upright or semi-upright plates to have been compressed in such a regular way. This again suggests that they are the impress of some organism, and not a shell

formed of several compartments. Even if we concede that these fossils were shells with separate plates, then the plates must be in their original position, or nearly so, and cannot have been upright. The disposition of the parts in the fossil is extremely peculiar. First, there are the end plates referred to the rostrum and carina, and these are not in exact opposition. The two end plates have, next to them, on opposing sides, a single lateral plate separated by a fairly wide interval. The remaining four plates on each side are in pairs at opposing ends, and are divided by a faint impressed line, but each pair is separated from the other by about the same interval as the single plate is separated from the end plates. In consequence of this arrangement, there is a certain asymmetry about the disposition of the parts. Such a structure is very unlike that of undoubted Cirripedes, and the inverted middle lateral plate is quite an anomalous structure.

Since the lateral parts do not extend to the middle of the fossil a narrow oblong space is left, but this is not in accord with Dr. Ruedemann's figure of the Trenton Limestone form (*E. trentonensis*), which has an oval opening. Of this Dr. Ruedemann said "a large elliptic sub-central node indicates the mud-filling of the aperture." Perhaps this inconsistency is of little consequence, for even with the aid of the specimen I cannot follow either the description or figure of *E. trentonensis*. Of more importance is Dr. Ruedemann's supposition that the opercular valves did not exist. They are considered to be a later development, designed to close in more completely the ventral side, and not to be fundamental structures.

The opercular valves of Cirripedes, the scuta and terga, are the most persistent of all the plates, and the post-larval development and other evidence show that they are among the first-formed plates. They would seem to be more fundamental than the wall-plates. The scutum is important in that it is the valve to which the adductor scutorum is attached. All the evidence is, therefore, against Dr. Ruedemann, and I feel sure no student of the Cirripedia would agree with him.

Examination of these fossils shows that, beyond a superficial resemblance to the sessile Cirripedes, there is not a single definite character shown by them that would justify their reference to the Cirripedia. It still remains to be proved that they are Cirripedes at all, and this emphasizes the futility of basing wide phylogenetic considerations on such problematic fossils. Dr. Ruedemann not only derived

them from the Phyllocarida, but, ignoring the great gap in time from Devonian to Recent, considers that they gave rise, through the problematic Devonian Cirripede *Protobalanus*, to the recent sessile forms of the Clithamaliidae (*Catophragmus*), and in turn to the Balanidae (*Balanus*).

While Dr. Ruedemann quotes Dr. Pilsbry's authoritative view as to the assumption, in the absence of palæontological evidence, that all acorn-barnacles descended from a primitive stock having eight wall-compartments, he evidently does not accept as authoritative Dr. Pilsbry's doubts (1916*, p. 11) as to *Protobalanus* being a Cirripede at all.

Protobalanus was one of the forms discussed by me in a paper ("Some Palæozoic Fossils referred to the Cirripedia," Geol. Mag. 1915, pp. 113-118), and certain inconsistencies in its structure as compared with Cirripedes were pointed out. It was stated "A re-examination of the specimen would be interesting, but it may now be said that it is exceedingly improbable that it is even remotely related to the genus *Balanus* or to any other member of the Balanidae."

It is true, as Dr. Ruedemann remarks, that, following Darwin, the Balanidae are currently regarded as derived from the Lepadidae through the reduction of the peduncle, but Darwin included also with the Balanidae the remaining sessile Cirripedes.

All the evidence points to the reasonableness of this conclusion, and that is why students of the Cirripedia are content to follow Darwin. The evidence, however, has since been carried still further. There can be no doubt that the Cretaceous sessile Cirripede *Brachylepas* was derived from the stalked forms included in the genus *Pycnolepas* (Cretaceous and Tertiary). The same can be said of the Cretaceous sessile Cirripede *Proverruca*, for in its structure *Proverruca* shows quite conclusively that it must have been derived from a symmetrical pedunculate Cirripede, such as *Calantica* (*Scillalepas*). The presence in *Proverruca* of two additional latera, of which one forms no part in the wall of the shell, but is merely lying on the outside of the adjoining plate and is on its way to suppression, is one of the most conclusive pieces of evidence in the whole of the Cirripedia.

Consequently, if we can trace these more primitive sessile Cirripedes back to stalked forms existing in the Cretaceous, it is extremely unlikely that the more specialized sessile

* Bull. U.S. Nat. Mus. No. 98.

Cirripedia included in the Balanidæ should not have been evolved from stalked forms.

If the Palæozoic forms *Eobalanus*, *Protobalanus*, *Palæocreusia*, and *Hercolepas* are Cirripedes, then the phylogenetic evidence renders it very unlikely that they can have any close connexion with the recent groups. If they are not Cirripedes, and there is no real evidence that they are, then Dr. Ruedemann's hypothesis falls to the ground. In the absence of evidence which places their reference to the Cirripedia beyond doubt, it would seem desirable to leave these forms out of phylogenetic discussions.

II.

Accompanying Dr. Ruedemann's paper on the Phylogeny of the Acorn Barnacles (1918) is a paper by Dr. J. M. Clarke (1918, "Possible Derivation of the Lepadid Barnacles from the Phyllopods," Proc. Nat. Acad. Sci. Washington, iv. pp. 384-386). Clarke, accepting Ruedemann's theory with regard to the sessile barnacles, attempts to show that the stalked Cirripedes were independently evolved from the Phyllocarida through the Palæozoic genera *Lepidocoleus*, *Turrilepas* (includes *Plumulites*), and *Strobilepas*.

In a discussion on these forms (1915, "Some Palæozoic Fossils referred to the Cirripedia," Geol. Mag. dec. vi. vol. ii. pp. 111-123), I wrote (p. 121), "While it is doubtful if certain of these fossils even belong to those genera, it certainly still remains to be proved that any of them belong to the Cirripedia," and (p. 123) "it may be said that we know very little of the relationship to one another of *Lepidocoleus*, *Plumulites*, and *Turrilepas*, and very little is known even of the structure of their shells. In none do we know the relation of the animal to the shell, and, except for the ornamentation and the downward growth of the plates, there seems to be no other character advanced in favour of their reference to the Cirripedia."

In spite of these remarks, although my paper is not mentioned, it is from these fossils that Clarke derives the whole of the stalked barnacles. It is, therefore, of interest that the zoologist Dr. H. Broch (1928, "Zur Ahnenfrage der Cirripedia," Sonderabd. die Naturw., Hft. xlv. p. 886) agrees that the Cirripede nature of these fossils is problematic, and thinks that they should be removed from the Cirripedia. In any case, he considers their inclusion in the ranks of ancestral forms is wrong and illogical. Dr. Broch, however, does not add anything to our knowledge of these curious

forms, but contents himself with a discussion of my paper, together with reproductions of some of the figures.

That the known structure of these forms is misunderstood is shown even in Clarke's paper. He evidently still confuses the perfectly distinct genus *Plumulites* with *Turrilepas*.

These genera were differentiated in my paper (1915*, p. 122), and it was there stated that, since it was possible to say positively that there were only four vertical rows of plates in *Turrilepas*, it was probable that there were four rows also in *Plumulites*; but Clarke still speaks of "four to six" rows. In *Lepidocoleus* there are only two vertical rows of plates. Clarke says that these two rows open back and front, but actually they only open along the narrow "free" margin.

The essential structure of the forms *Lepidocoleus*, *Plumulites*, and *Turrilepas*—I do not include *Strobilepas*, because I have never examined the unique specimen—is that of a blade-shaped shell, the plates overlapping along the broad "fixed" margin, and opening along the narrow "free" margin. In all three forms the shell tapers off towards the apex, and in *Lepidocoleus* there is at the base a somewhat modified plate. Evidence is available to show that *Turrilepas* had a modified plate at the base, and this makes it all the more probable that the so-called "cancellated" plates of *Plumulites* are the modified basal plates of that form. This goes far to show that these fossils cannot represent the "capitula" nor the "peduncle" of Cirripedes, but whether one regards them as Cirripedes or not they constitute the entire shell of the animal.

By tedious and careful cleaning a number of the plates of *Lepidocoleus* entirely free from matrix, as well as of some median plates of *Turrilepas*, it can be shown that in these plates there is a sub-circular muscle-scar. The plates were selected at random, of different sizes, some from the right side and others from the left, and in each plate such a muscle-scar was found. The evidence seems conclusive that all the median plates of *Turrilepas* and both series of plates in *Lepidocoleus* had such a muscle-scar.

When one considers that in some of these fossils there are as many as thirty plates in a vertical row, and each plate of the two rows has a muscle-scar, it is difficult to imagine any relationship with the pedunculate cirripedes in which one plate only, the scutum, has such a muscle-scar. It is true

* See also diagnoses of *Plumulites* and *Lepidocoleus* in Withers, 1921, Ann. & Mag. Nat. Hist. ser. 9, vol. viii. p. 124; 1922, *ibid.* ser. 9, vol. ix. p. 653.

that during the whole of the Carboniferous and Triassic periods there have not been found any cirripede remains, and this is extremely curious, seeing that during these periods the seas teemed with marine life of almost all groups. However, *Lepidocoleus* and *Plumulites* range into the Devonian, *Turrilepas* (s. str.) being confined to the Middle Silurian, and the time-interval between the Devonian and the Rhætic seems quite insufficient, if these forms be the ancestors of pedunculate cirripedes, for them to have undergone such extraordinary structural changes. There can be no doubt that the Rhætic form "*Pollicipes*" *rhæticus* is an undoubted cirripede, for the structure of its plates differs in no way from any ordinary recent stalked cirripede.

How, then, in the face of this evidence, can we regard it as proved that these Palæozoic fossils are Cirripedes?

Even if they were Cirripedes (and they show no characters sufficient to justify their reference to the Cirripedia), their structure renders it improbable that they could have any close relationship to the recent group of pedunculate Cirripedes. As I have said elsewhere, the main reason for including these Palæozoic fossils in the Cirripedia appears to be the great difficulty in referring them to any other class of animals. It is hoped before long to be able to show that they belong to another group.

XXXVIII.—On a new Tapeworm from the Duck. By F. J. MEGGITT, M.Sc., Ph.D. (Professor of Biology, University of Rangoon), and MAUNG PO SAW (University of Rangoon).

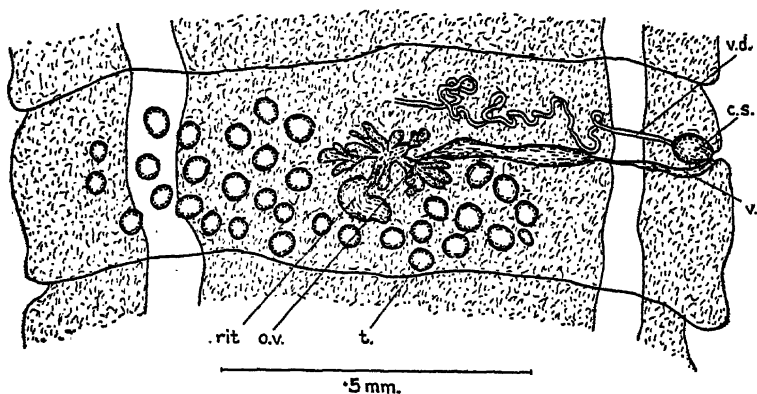
THE material upon which the following description is based was collected from the intestine of a duck in Rangoon. So far, the species has only been found once, but work is in progress to determine the frequency of its occurrence.

Length 110–120 *, width 0.2. Scolex 0.26–0.37 diam. Rostellum 0.026–0.3 diam., extending posteriorly past anterior margin of suckers, armed with approximately 150 T-shaped hooks, 0.007–0.009 long, in two rows. Suckers armed with nine complete circles of hooks, the hooks decreasing in size internally. Proglottides broader than long, except the end ones, which become longer than broad. Musculature weak, consisting of an inner transverse layer and an outer longitudinal one of very much scattered bundles, each containing

* All measurements in millimetres.

few fibres, extending to the subcuticula. The state of preservation of the musculature was poor.

Genital pore unilateral, slightly anterior to centre of proglottis margin. Genital ducts pass between longitudinal excretory vessels. Cirrus-sac 0.58-0.84 long, extending to nerve. Vas deferens only slightly coiled. Testes vary from 24 in young but mature segments to 39 in older ones, the usual number being 27-9-12 poral, 18-20 aporal—an increase in number of the poral testes being compensated for by a corresponding decrease in the aporal; mostly confined within longitudinal excretory vessels, but with a few lying on the vessels themselves and 2-3 external to them. *R. penelopina* (Fuhrmann, 1909) from Galliformes is the only



Raillietina (Ransom) parvuncinata, sp. n. Young mature proglottis.

c.s., cirrus-sac; ov., ovary; t., testes; v., vagina; v.d., vas deferens; vit., vitelline gland.

species of *Raillietina* with a similar extension of the testes. Ovary slightly poral, consisting of numerous finger-like outgrowths and a small central portion, occupying two-thirds of proglottis width. Vitelline gland compact. Egg-capsules 40-50, extending laterally to longitudinal excretory vessels, and each containing 11-13 eggs. The number apparently increases with age; in the younger gravid segments there are 5-6 eggs, increasing progressively to 13 in the fully gravid ones. The complete number can only be determined from sections.

The possession of T-shaped rostellar hooks, single genital pores, and egg-capsules place the present form in the genus *Raillietina*, and unilateral genital pores and eggs in groups in

capsules in the subgenus *Ransomia*. Referring to a key previously given (Meggett, 1920, p. 16), the species most closely allied is *R. cyrtus* (Skrjabin, 1914, p. 67), from an undetermined species of *Anas*; this may be distinguished from the Rangoon material by the smaller number of eggs in each capsule (5-8), the larger number of testes (35-40), the greater extent of the ovary and egg-capsules, and the shortness of the proglottides in proportion to their width. Of the forms not wholly included in the key by reason of their incomplete description, *R. cantaniana* has eggs singly in parenchyma, *R. penetrans* much larger rostellar hooks and more rows of acetabular hooks, *R. insignis* the vitelline gland anterior to the ovary and a persistent uterus, *R. urogalli* larger rostellar hooks and more testes, and *R. cohnii* few testes. It is therefore necessary to create for the present form a new species, for which we propose the name *Raillietina* (*Ransomia*) *parviuncinata*, sp. n.

Type-specimens sent to Molteno Institute for Parasitology, Cambridge; British Museum; Bureau of Animal Industry, Washington; Indian Museum, Calcutta; and Laboratoire de Parasitologie, École de Médecine, Paris.

LITERATURE.

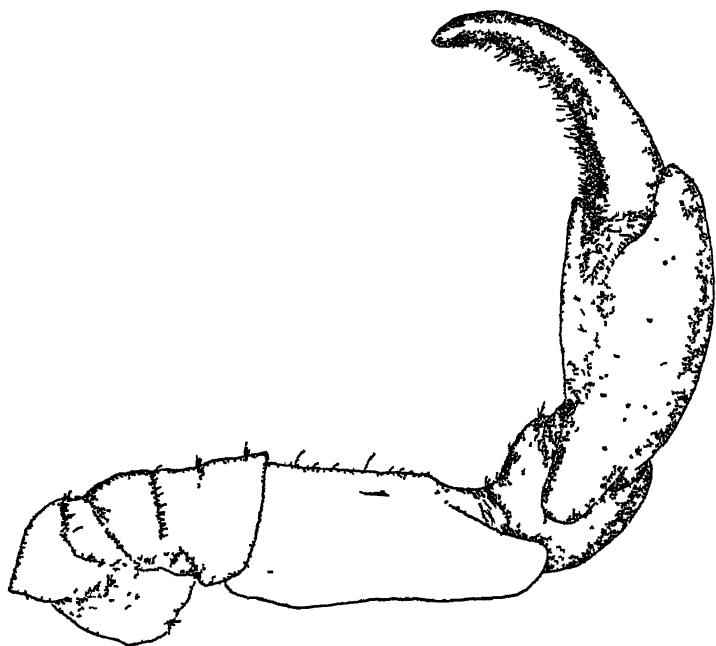
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XXXIX.—*An Abnormal Specimen of the Edible Crab* (*Cancer pagurus*). By W. T. CALMAN, D.Sc., F.R.S.

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THE specimen here described was lent for examination by Messrs. Hastings and Stewart, of Hartlepool, by whom it will be presented to the local museum. It is like the specimen which I described in 1913 (Ann. & Mag. Nat. Hist. (8) xi. p. 399) in having one of the walking-legs partially modified into the likeness of a cheliped; it differs in that the modified limb is one adjacent to a cheliped and that the modification is not so complete, there being no immovable finger formed on the propodus. It appears to deserve description chiefly because it again shows very clearly the "coexistence of incongruous characters on the outer and inner sides of the appendage."

The crab is a male, and measures 146 mm. across the carapace. All its appendages are normal except the first walking-leg (fifth thoracic appendage) on the left side, which is considerably stouter than the other legs, and, although monodactyle, presents many resemblances to a cheliped. The *coxa* does not differ from that on the opposite side of the body. The *basi-ischium* is more enlarged distally than in the normal limb, and has some scanty tufts of hair on its anterior edge. The *merus* is short and thick, being 34 mm. long, 18 mm. wide, and 18 mm. thick (*i. e.*, approximately



Abnormal leg of *Cancer pagurus*.

antero-posteriorly) at the distal end; on the corresponding limb of the opposite side the measurements are 46, 15, and 12 mm. respectively. Its anterior edge and upper face are more hairy than in a normal cheliped. The *carpus* is considerably inflated, as in the chelipeds, but it retains marked characters of the walking-leg in the presence, on the dorsal surface, of two granulated ridges separated by a smoother interspace, the anterior ridge carrying also scattered tufts of hair, which are continued on to the anterior face of the carpus,

the posterior (or outer) face being quite smooth. The *propodus* measures $42 \times 23 \times 16$ mm., and repeats almost exactly the features of the cheliped *propodus* except that there is no trace of an immovable finger, but, in the place where it would have stood, an irregular band of scanty tufts of hair runs back, on the lower anterior surface, from the articulation of the *dactylus*; on the upper edge of the *propodus*, just at the carpal articulation, a patch of enlarged granules continues for a little way the granular ridge of the carpus. The *dactylus* is blunt-pointed and more strongly curved than those of walking-legs or chelipeds; on its outer and posterior faces it resembles that of a cheliped, being quite smooth, with scattered punctations, and having more than the distal half coloured black; on the lower and anterior faces the resemblance to the *dactylus* of a walking-leg is unmistakable, there being three longitudinal bands of close-set bristles and a narrow longitudinal groove in the space between the two anterior bands.

The characters of cheliped and walking-leg are united in this appendage, but not intermingled; for the most part they are separated by a plane which is longitudinal with respect to the axis of the limb. This is very clear in the case of the *dactylus*, but it can also be traced, though less easily, in the *propodus*, carpus, and even in the merus. The separating plane, however, is twisted, for, while the walking-leg characters in the *dactylus* are confined to the antero-inferior face, in the proximal part of the *propodus* they become antero-dorsal and in the carpus completely dorsal.

XL.—*The Application of the Law of Priority.*

By HUGH WATSON, M.A.

THERE is much difference of opinion about the application of the so-called Law of Priority, set forth in the International Rules of Zoological Nomenclature. Some zoologists say that an attempt should be made to apply it strictly to every name, however much confusion this may now cause. Others maintain that it should only be applied to cases where there already is confusion, owing to the same name being in use for different animals or different names for the same animal, and they object to names that everyone has used for certain animals for generations being changed or transferred to other forms because their present use is found not to accord strictly

with the letter of this "Law." They think that these cases should be submitted to the International Commission on Zoological Nomenclature, which has plenary power to suspend the application of the Rules to such names. Both parties, however, concur in wishing that there was more agreement on this subject, and each deplores the fact that other zoologists are so foolish as not to hold the same view as they do. But agreement is only likely to be reached if the arguments on both sides are first put forward for consideration; and I have been urged to try to make clearer some of the reasons why so many zoologists and palæontologists are opposed to the strict application of the Law of Priority to every single case.

I.

The Law of Priority was established in order, if possible, to eliminate confusion and attain uniformity in zoological nomenclature. Yet it is evident that to change a name that has been uniformly applied to a particular species or genus for very many years simply introduces confusion where there is none. Why, then, is it ever sought to apply the Law of Priority to such cases? The answer usually given is that the confusion introduced will be only temporary, and that it is only by investigating and rigidly applying the Rules to every case that ultimate uniformity is likely to be established. The priority purists maintain that it is necessary to increase confusion at present in order to establish a better state of things when the period of transition is over.

But will the period of transition ever be over? When a competent authority laboriously investigates the antecedents of a name and tells us that it is invalid according to the Law of Priority, this does not settle the matter; for very frequently another authority will disagree with the first, or will question the validity of the new name which is proposed in the place of the old one, and thus endless disputes arise and confusion is perpetuated. For example, certain able writers have for several years been endeavouring to bring the nomenclature of snails and slugs into strict conformity with the Rules. Yet the conclusions which they have published from time to time, instead of having produced uniformity in nomenclature, have often simply initiated disputes. The views expressed by one malacologist will be taken exception to by another, who also bases his conclusions on the Law of Priority; or the same writer will himself change his opinion about the validity of names the use of which he formerly upheld.

Many illustrations might be given of the confusion that is

caused by always attempting strictly to apply the Law of Priority. Consider, for example, the case of the two common species of *Cochlicella*. Nearly all of the older writers called the more pointed species *acuta* Müll., and the more ventricose one *ventricosa* Drap. or *ventrosa* Fér.—singularly appropriate names. Then Bourguignat said that the ventricose species should be termed *barbara* Linn. Later, however, other authorities stoutly maintained that it was the more pointed species which was really Linné's *barbara*, and also that the ventricose form was the true *acuta* of Müller. Accordingly, these names were transposed. The result of this transference of names from one species to another is that if anyone refers simply to *barbara* Linn. or *acuta* Müll., it is impossible to know of what species he is speaking. And now that this utter confusion has been created by the priority purists, they tell us that probably the usage of the older authors was the correct one after all*.

But it is unnecessary to give further examples in order to prove that the strict application of the Law of Priority to every case is never likely to lead to stability in nomenclature. For it is evident that, so long as people minutely investigate the antecedents of old names, they will always be discovering new facts bearing upon their validity: specimens labelled in the handwriting of the older authors will be found in obscure collections; the dates of publication of ancient books will prove to differ slightly from what had been thought probable; and other facts will continue to come to light, demanding renewed changes in the future. Moreover, different authorities will continue to regard the same facts from different points of view, and to draw opposite conclusions from them, as they do at present. Thus the confusion caused by the attempts to discard generally accepted names, or to transfer them to other genera or species, will not be temporary, but perpetual, if it is sought always strictly to apply the Rules to such cases regardless of the consequences. And this will be so even if the Rules themselves never change. If they do change, it is still more obviously futile to upset our nomenclature in an attempt to bring every name into strict accordance with the present Rules. Nevertheless, as science progresses, our concepts gradually become modified with the acquisition of new knowledge; and if our system of nomenclature is to keep pace with the progressive evolution of our ideas on classification etc., it also must be modified from time to time.

* See Kennard and Woodward, Proc. Malac. Soc. vol. xiv. 1920, pp. 80-83.

It seems clear, therefore, that to attempt strictly to apply the Law of Priority to old and generally accepted names will only result in confusion which is likely to be perpetual.

II.

Some writers, however, have put forward other reasons for strictly applying the Law of Priority to every case. It has been maintained, for example, that this should be done in order to render justice to our predecessors. But surely we render scant justice to our predecessors if we reject the names that they generally employed because we find that their use does not strictly accord with certain rules which were not formulated when these names were originally established. Let us consider a single example. What justice do we render to any of our predecessors by discarding the specific name *limbata* Drap., 1804, which they all gave to a common species of *Hygromia*, in favour of the name *odeca* Locard, 1882, which its author did not intend to be applied to that species, simply because in 1778 Da Costa was so ill-advised as to give the name *Helix limbata* to a species of *Planorbis* that had been twice named already—an action which subsequent writers generously ignored? * And in those cases in which it is sought, on the technical grounds of priority, to replace a name that has long been in general use by a still older one, it will generally be found that the reason why the older name fell into disuse was that it was originally proposed in a vague or unsatisfactory manner, and its revival will therefore do no honour to its author, but will rather do an injustice to the man who subsequently named and described the genus or species more adequately. *It is therefore evident that if we were strictly to apply the Law of Priority to all cases we would not be rendering more justice to our predecessors, but often less.*

III.

It has also been urged that a scientist should always carefully investigate the priority of the names that he uses in order to show that he possesses the erudition necessary for scientific research. But to prove that one is a good bibliophile does not show that one is also a good scientist. On the contrary, it is evident that the more time that a man shows he has spent poring over ancient books in libraries, the less time can he have devoted to studying Nature at first

* The reason for applying the name *odeca* to this species is because it is now thought that Locard was mistaken in regarding the form to which he gave this name as specifically distinct from *limbata* Drap.

hand, and the less original knowledge can he possess of natural science. And, in any case, no one but a pedant would seek to justify the strict application of the Law of Priority on the grounds that it gave him an opportunity of displaying his erudition. That such a reason should have been put forward is good evidence of the weakness of the other alleged reasons for strictly applying the Law of Priority to every case. Moreover, the exaggerated importance that has become attached to the subject of strict priority has not only made people spend much valuable time in disputes about nomenclature, which might have been devoted to scientific research, but it has also led to the premature publication of hundreds of new and unnecessary names, in order to try and gain that priority which certain authors and editors now so greatly desire—and every systematist knows how much this has interfered with the progress of systematic zoology. *It would thus appear that, besides creating endless confusion, the attempt invariably to apply the strict letter of the Law of Priority leads to much time being diverted from scientific research, tends to encourage pedantry, and generally retards the progress of zoological science.*

IV.

It is sometimes forgotten that zoological nomenclature is not a branch of science, but a branch of literary art. To discern and to understand the facts of Nature—such is the business of the natural scientist; but creation and expression belong to the province of the artist. Now the general principles of art are quite different from those to which a scientist is accustomed, although they apply equally to all the manifold branches of art, even if that word be used in its very widest sense. And if we study closely the history of artistic development from the earliest times to the present day, we see that one of the fundamental principles of art is this: that success in art is only achieved when the whole energy of the artist is freely devoted to attaining the end he has in view, every detail of his work being moulded by him into harmony with the spirit of the whole; while, on the other hand, decay in art seems invariably to take place if the artist devotes himself to the strict carrying out of precise rules and regulations about the means which he should employ to attain his end. We see the effects of this principle clearly revealed in the evolution of almost every branch of art in any age—in ancient Egyptian painting or modern English literature, in classical architecture or the ritual of

the Mediæval Church, to name but a few examples. Over and over again the establishment of definite rules which the artist was enjoined strictly to follow appears to have resulted in the downfall of that branch of art which the rules were designed to aid. Indeed, a general survey of the history of man's many efforts to express himself forms a striking confirmation of the fact that the letter killeth but the spirit giveth life.

Now, is it likely that a general principle that seems to have applied to every other art will not apply to the art of zoological nomenclature, and that here alone success instead of failure will follow a meticulous adherence to conventional rules in every case? Surely it would be unwise to ignore in this manner the lesson that history so clearly teaches. *For in the past man's efforts to express his ideas have resulted in repeated failure when he has bound himself to the strict observance of conventional rules as to the means he should take to achieve his end.*

V.

The scientist introduces order into his conceptions of natural phenomena by explaining them in terms of the interaction of invariable rules, which we speak of as the Laws of Nature. It is therefore not surprising that the scientific mind easily falls into the error of thinking that order can be best introduced into nomenclature by the strict application of invariable rules, forgetting the fundamental difference that exists between the art of expression and the understanding of phenomena. Thus some scientists insist that any freedom from the invariable application of the Rules must inevitably produce chaos in nomenclature, and it is therefore necessary to show why this assumption is false.

It is a sound principle of all art that each work must be fashioned so as to serve its purpose as well as possible. Now the purpose of a name is to indicate clearly to others what one is speaking of, without having to describe the thing at length. Therefore, that name best serves its purpose which is most intelligible to those whom one is addressing.

In ordinary speech this criterion of intelligibility is what guides us in the choice of names; we observe no precise rules of priority, and the result is a minimum of confusion. Even when new names have to be introduced for new inventions, no chaos results. I call the thing with which I am writing a "fountain pen," not because I know that this name was the first to be employed in literature for such an instrument, but because it is the usual name for it and therefore

the most intelligible. But supposing some committee of pedants were to decree that all names introduced into the English language since 1758 or any other date were to be used strictly according to a law of priority which they had formulated, regardless of the present use of the names, then, indeed, chaos would result.

Exactly the same principle applies to the Latin names of animals. No chaos can possibly arise through the retention of all names that are in general use for particular animals, and are therefore generally intelligible; it is the changing of these names that causes such endless confusion. The object of every paper is to convey one's ideas to other people, and it is evident that this purpose can best be achieved by using names that are generally intelligible, instead of others with which no one is familiar. When there already is confusion owing to different names being in current use for the same genus or species, or the same name for different genera or species, it is another matter. Nearly all zoologists agree that in such cases the Rules should be strictly applied, and accordingly those names that the majority think the Law of Priority requires will be the most generally used, and therefore those which the criterion of intelligibility would also suggest should be adopted. In any cases in which there might be a difference of opinion as to whether the use of a certain name for a particular animal was sufficiently general for less confusion to be caused by its retention than by the application to it of the Law of Priority, the view adopted by the majority of authors would of itself soon decide the matter, if it had not been settled by the question having been referred to the International Commission on Zoological Nomenclature, in accordance with the resolutions on page 890 of the Report of the Ninth International Congress, to which I shall refer again later.

We see, therefore, that no confusion should result from not seeking to apply the Law of Priority to those cases in which none actually exists at present.

VI.

An attempt has been made to show that even if all zoologists agreed that it was desirable to investigate the history of every name in general use, and strictly to apply the Law of Priority to each case, it would lead to endless confusion instead of to uniformity. There is, however, no need to demonstrate that this result is inevitable if some are willing always to apply

the Rules strictly, while many others are not. It is obvious that no priority purist can possibly expect his methods to achieve uniformity in nomenclature if he cannot persuade practically all of us to adopt them. Yet it is well known that a large number of eminent English zoologists and palæontologists remain strongly opposed to the strict application of the Law of Priority to every case. And even those who insist that the Rules should always be applied often ignore one or two of them in practice, and may even abandon them altogether in private conversation, preferring to be intelligible rather than conventional.

In foreign countries there is the same widespread opposition to the invariable application of the Law of Priority. Read, for example, what one of the most thoughtful students of French snails wrote about the Law of Priority in chapter xiii. of his important work on '*Le Polymorphisme des Mollusques de France*'*. Or listen to this extract from a paper by a well-known American palæontologist:—"After the nomenclature has been revised it will be stable until somebody revises it again, just so long and no longer. Every new reviser . . . is liable to interpret the case differently, and each difference in the interpretation of some obscure or minor point is liable to result in a whole series of alterations of well-known and important names. . . . The plain fact of the case is that scientific nomenclature has come to a pass where the common name of the species is the only name with any permanency or prospect of permanency, and it is necessary to use it . . . in order that one's readers—aye, even other systematists—shall know what animal is under discussion. . . . To-day [scientists] write descriptions under a scientific name dug out of some old-forgotten treatise . . . and then explain by means of the 'dear old familiar name of the text-books,' or the still dearer vernacular name, what animal it is that they are describing. Fashions change; not always in the way of progress"†.

But it is unnecessary to look further than the volume issued by the Ninth International Congress of Zoology, held at Monaco in 1913, in order to see how widespread and insistent is the opposition to the strict application of the Law of Priority to every case. The first paper read before the Section of the Congress devoted to nomenclature was by

* Coutagne, *Mém. Soc. Agr. Sci. et Ind. Lyon*, ser. 7, vol. iii. 1895, pp. 412-428.

† Matthew, '*Science*,' n. s. vol. xxxvii. 1913, p. 789.

Prof. Brauer of Berlin : to indicate its nature one need only give its title, which reads (translated) "The Necessity for the Limitation of the Law of Priority" (p. 815). Cossmann of Paris said that the Rules were established by the Congress solely to introduce order, and not to encourage bibliophiles to renew continual researches about priority in more or less obscure works ; for these so-called rectifications produced perpetual confusion and loss of precious time, to the great detriment of anatomical, biological, or phylogenetic research, which alone had a scientific interest. He therefore pleaded for a wise and discrete application of the Rules (p. 822). Prof. Monticelli of Naples presented a petition from the Italian Zoological Union in favour of establishing definite exceptions to the Law of Priority (p. 824), which Prof. Ghigi of Bologna said was what the majority of Italian zoologists desired (p. 828). Prof. Williston of Chicago said (p. 827), "I think I am safe in saying that the majority of American Zoologists are opposed to the rigid application of the law of priority. The American Zoological Society, the American Entomological Society and Paleontological Societies certainly are . . . (p. 828), the majority desire such modifications in the Code as will permit the retention of names that have long been in use without regard to priority." Sir Sidney Harmer communicated a protest signed by twelve zoologists resident in India against the strict application of the Law of Priority in all cases (p. 829), and he himself maintained "that the time had come for admitting exceptions to the Law of Priority, partly on the ground that finality has not been obtained and does not seem likely to be obtained by depending entirely on this law" (p. 830). Prof. Navas of Saragosa pleaded for more liberty ; instead of adding to the rules and exceptions, he would wish to curtail them (p. 831). Nevertheless, the members present unanimously adopted the proposition made by Prof. Brauer to add to the Rules of Nomenclature an article admitting exceptions to the Law of Priority, (1) when its application would have involved transferring a name from one genus or species to another, (2) when a name had been used in scientific works for a genus for fifty years prior to 1890, or (3) when the name with priority had gained no entrance into scientific classification for twenty years ; the exceptions to be approved and published by the International Commission on Nomenclature after examination by a subcommission of specialists (p. 831).

Lastly, let us proceed to the Report of the International Commission itself (pp. 852-891). The Commission fully

admitted that the attempted imposition of the Law of Priority, as they had formulated it, had been received with a storm of indignation (pars. 61, 65, 68, 94, etc.), that the President and Secretary of the Commission at the Berlin Congress had earnestly appealed for exceptions to be allowed (par. 94), and that they themselves felt very keenly the inconvenience of the Law (pars. 95, 98). They said that they were opposed to admitting exceptions into the Code of Rules (pars. 95, 97), but they formally and unanimously recommended to the Congress that wherever the strict application of the Rules "will clearly result in greater confusion than uniformity" they should be empowered to suspend their application after the case had been duly published and considered (pars. 112-116). The resolutions embodying this recommendation were afterwards unanimously approved by the Section on Nomenclature of the International Congress (p. 892); for it is evident that the object of Prof. Brauer's proposed new article should be equally attained by limiting the application of the Rules in this manner.

It is clear, therefore, that those who insist on the strict application of the Law of Priority to every case, regardless of the confusion created, are acting contrary to the wishes of the International Congress and are ignoring the resolutions adopted at the Monaco meeting.

If we also consider all the other facts mentioned above, is it too much to ask zoologists to agree not to rake up the antecedents of old generally accepted names with a view to finding possible technical flaws in their validity? Or, if such flaws are discovered, will they not agree to submit the cases to the International Commission on Zoological Nomenclature in accordance with their resolutions mentioned above, instead of ignoring these resolutions and perpetually introducing confusion into our nomenclature in cases where none existed? *For, apart from the other reasons already given, it is manifest that the strict application of the Law of Priority to every case can never produce uniformity when so many able zoologists in all countries are opposed to this action; and also that those who insist on always strictly applying the Rules regardless of the confusion entailed are ignoring the resolutions unanimously passed at the last International Congress of Zoology.*

XLI.—*Solenodonsaurus, Broili, a Seymouriamorph Reptile.*
By HELGA S. PEARSON, M.Sc., University College, London.

BROILI has recently* given the name *Solenodonsaurus junenschii* to a specimen from the Upper Carboniferous of Nürschan (Bohemia) which, in 1905, knowing only half of the slab in which it is preserved, he had mistaken for the rachitomous Labyrinthodont *Cochleosaurus bohemicus*, Fritsch. The fortunate discovery by Prof. Janensch of the reverse half of the slab in the Berlin University Geological Museum enabled Broili to give a fuller account of this specimen, and to show that it is really a Cotylosaurian reptile, and not a Labyrinthodont†.

Another specimen of this genus, from the same beds, has come into the hands of Prof. D. M. S. Watson, at whose suggestion I am giving the accompanying figures and description. He points out that its affinities are rather with *Seymouria* than with any other known Cotylosaur.

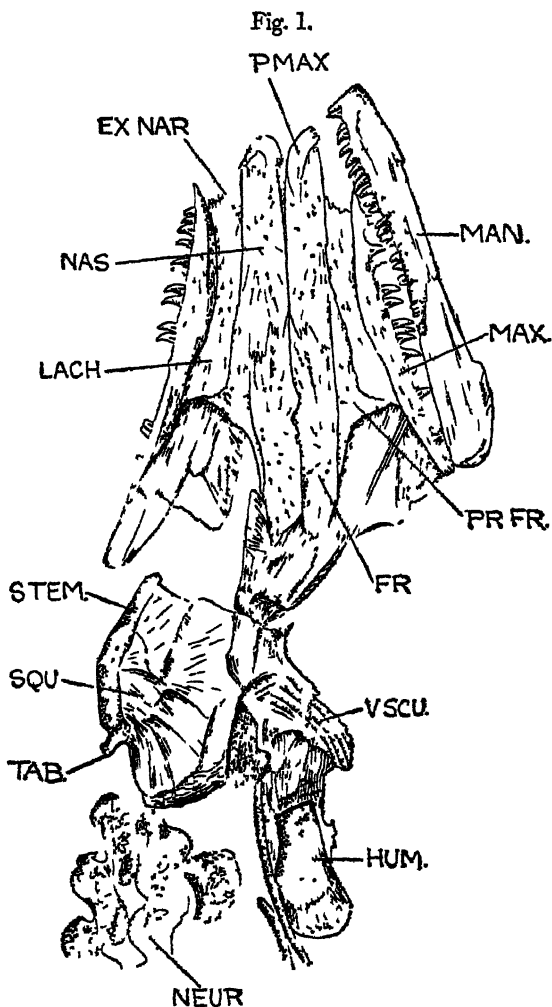
Of actual bones those of the anterior end of the skull are alone preserved. The rest of the specimen consists of impressions on the matrix. Among these can be recognized that of the left squamosal, with parts of the tabular, supratemporal, postorbital, quadrato-jugal and jugal articulated with it (fig. 2), and those of a proximal end of a humerus, three vertebral neural arches, a part of the ventral armour of scutes, several scattered ribs, and a small group of metacarpals and carpals (fig. 3).

Skull. The skull is only about one-third the size of that of Broili's specimen, which is in agreement with the evidence from the vertebræ that the animal was a very young one. The surfaces of the bones are marked with a characteristic sculpture of pits shallowing out into radiating grooves which follow the lines of ossification; it is much too diffuse and irregular to be described as a honey-comb structure.

Frontals, prefrontals, nasals, lachrymals, and maxillæ are present, the lateral bones pressed outwards to form a flat

* Broili, "Ein Cotylosaurier aus der oberkarbonischen Gaskohle von Nürschan in Böhmen," Sitzungsberichte der Bayerischen Akademie der Wissenschaften, Math.-naturwiss. Abt. 1924.

† Broili, "Beobachtungen an *Cochleosaurus bohemicus*, Fritsch," Palæontographica, vol. lii. 1905, p. 1.



The remains of a young individual of *Solenodonsaurus janenschii*, Broili, from the Upper Carboniferous of Nurschan, Bohemia. The anterior bones of the skull are alone present, the rest is represented by impression. * natural size.

EX.NAR.=external naris; FR.=frontal; HUM.=humerus; LACH.=lacrimal; MAN.=mandible, MAX.=maxilla; NAS.=nasal; NEUR.=neural arches; P.MAX.=premaxilla; PR FR.=prefrontal, S.TEM.=supra-temporal; SQU.=squamosal; TAB.=tabular; V.SCU.=ventral scutes.

plate with the dorsal ones; their relations may best be made out from fig. 1. Sutures are a little hard to determine, owing to the fine splinter-like character of the bone. The lachrymals extend in the primitive reptilian manner from the orbit behind to the nostril in front. The premaxillæ are incomplete and flattened forwards; a groove in the matrix appears to represent the displaced palatal process of the left one.

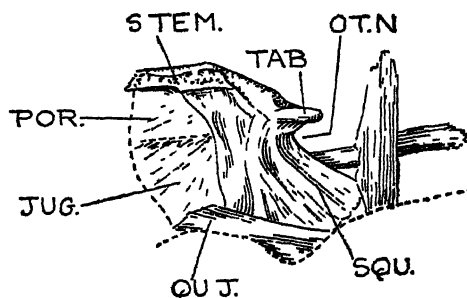
The anterior end of the right mandible is in place opposite the right maxilla; the tooth-series on maxillæ and mandible is incomplete, but many of the teeth are well preserved and are of the characteristic type described by Broili—slender, recurved at the tip, and with a median groove at the base; just as in his specimen the anterior and posterior teeth are smaller than those between.

Fig. 2 is of a plasticine squeeze from the impression of the left squamosal, tabular, and adjoining bones. (In figs. 1 and 3 two fragments of the slab have been removed from the posterior end of this impression to show the vertebræ concealed beneath them.) The small otic notch is well shown, with the projecting horn of the tabular above it. Anterior to the tabular is a narrow strip of supra-temporal; this passes forwards, in front of the anterior border of the squamosal, above a flat area of bone which appears to be divided into two by an antero-posteriorly running suture, and to represent the posterior portions of a postorbital and jugal. The squamosal, whose surface is thrown into wavy ridges, articulates with these two bones in front, with the supra-temporal and tabular above, and with a splint-like quadrato-jugal below.

Vertebræ. The vertebral column is represented by the impression of the neural arches of three vertebræ in articulation with one another, and by the rather unclear impression of part of a single centrum at some distance from them.

The neural arches show that the animal must have been very young, for their lateral halves are not yet fused; each arch is lying with its inner surface uppermost, flattened out into the same plane as its fellow, which it barely touches along its dorsal edge. The arches are squat and low, as in *Seymouria*, the zygapophyses wide apart, and the neural spines apparently undeveloped. (In Broili's adult specimen the shape of the lower part of the arch, with widely separated zygapophyses, is essentially the same as here, but neural spines have been developed dorsally as flat median plates.) The exposed inner surface of each half-arch shows a roughened semilunar articular facet for the opposite half above the

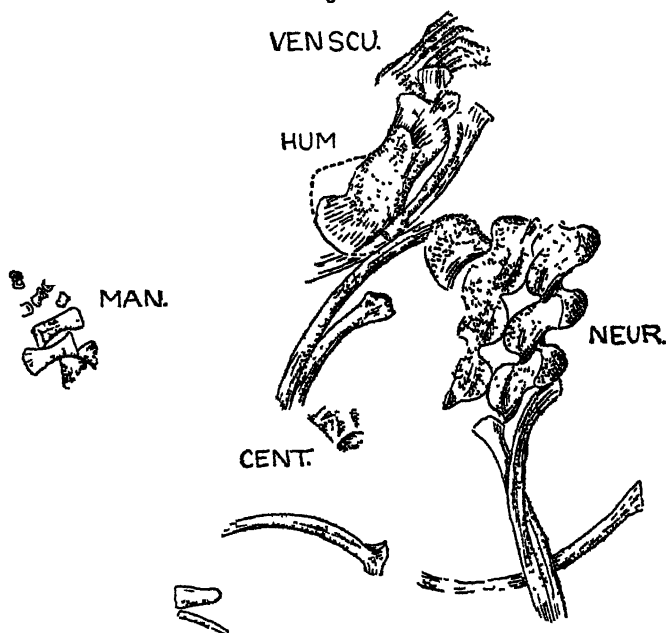
Fig. 2.



Drawing from a plasticine squeeze of the impression of the left squamosal and adjoining bones. $\frac{1}{2}$ natural size.

JUG.=jugal; OT.N.=otic notch; P.OR.=posterorbital; QU.J.=quadrato-jugal; S.TEM.=supra-temporal; SQU.=squamosal; TAB.=tabular.

Fig. 3.



Drawing from a plasticine squeeze of the impression of the postcranial parts. $\frac{1}{2}$ natural size.

CENT.=centrum; HUM.=humerus; NEUR.=neural arches;
MAN.=manus; VEN.SCU.=ventral scutes.

neural canal, and a similar facet where it rested against the centrum below the neural canal.

Of the centra belonging to these three arches there are no certain signs, but the plasticine squeeze of the incomplete isolated centrum just mentioned (see fig. 3) has a V-shaped depression in its flank which appears to be that for reception of the pedicel of the neural arch.

Ribs. The ribs, of which there are upwards of half-a-dozen fragments scattered about the slab, are single-headed (unlike *Seymouria* ribs) and essentially similar to those of Broili's specimen.

Ventral scutes. Anteriorly, by the side of the squamosal, is a little group of narrow ventral scutes, overlapping each other like tiles to form a close armour. The impression probably represents their inner surface. Two rows of these scutes on the right side of the impression meet an indistinct third row at a wide angle; this must have been the position of the mid-ventral line of the animal. One or two isolated scutes further back behind the ribs show that in shape each was a short spindle, with a groove stretching halfway along one side where it overlapped a projecting ridge on the neighbouring scute. Scutes of this type are known in no other reptile.

Humerus. The squeeze of the humerus, which lies just behind the patch of ventral scutes, shows chiefly its distal end. The big entepicondyle typical of Labyrinthodonts and Cotylosaurs is overlapped by matrix, through which, however, its outline can be detected (I have dotted it into fig. 3). The proximal end, which should stand out as a plate at right angles to the distal, is, as in Broili's specimen, crushed and partly broken away.

Digits. The manus (which lies so far out to the side that I have not included it in fig. 1) is represented by four metacarpals, two of them incomplete, and a few phalanges, as shown in fig. 3.

Measurements.

	mm.
Width across top of skull between orbits	10
Length from front of orbit to back of nostril	about 20
Length of nasal bones	" 18
Depth of mandible beneath orbit	" 5.5
Breadth of distal end of humerus at its widest part.	" 9.5
Breadth of shaft of humerus at its narrowest part .	" 5
Distance between the prezygapophysis of one neural arch and that of the next, when articulated ..	" 5.7
Height of neural canal	" 2.3
Length of the two complete metacarpals	5

Conclusion. Broili has already shown that *Solenodonsaurus* is a Cotylosaur. The shape of its neural arches, the presence of a small otic notch in the skull, and the general Labyrinthodont appearance of the latter further justify its inclusion in Watson's order Seymouriamorpha*, the most primitive division of the Cotylosaurian group, hitherto occupied by *Seymouria* alone.

Differences from *Seymouria*, showing an advance in the direction of the later Cotylosaurs, lie in the single-headed nature of the ribs and in the growth of prominent neural spines in the adult. The sharp recurved teeth with a median groove at their base, very similar to those in some of the Microsaurs, are also different, for the *Seymouria* tooth is folded like that of a Labyrinthodont; teeth, however, are never a character of much systematic value.

BIBLIOGRAPHICAL NOTICE.

Bacteriology: a Study of Microorganisms and their Relation to Human Welfare, discussing the History of Bacteriology, the Nature of Microorganisms and their Significance in connection with Pathology, Hygiene, Agriculture, and the Industries. By H. W. CONN and HAROLD J. CONN. Baltimore: Williams and Wilkins Company, 1923. 8vo. Pp. 441.

THE intention of the authors of this volume can be best explained by the following extracts from their preface:—"Early in 1916 a conversation between the authors of this book brought out the fact that there was need of a textbook in bacteriology which should deal with general bacteriology and its applications both to medicine and to agriculture. This book, growing out of that conversation, is intended primarily for college classes in first year bacteriology, composed partly of students who intend further specialization and partly of those who plan to take no further work along this line and wish a general knowledge of the important applications of bacteriology, as well of the principles that underlie it. . . . Another thought kept in mind in planning the book was the historical treatment of the subject. There is no science that has had a more intensely

* Watson, "A Sketch Classification of Pre-Jurassic Tetrapod Vertebrates," Proc. Zool. Soc. Lond. 1917, p. 171.

interesting history than bacteriology; and yet few textbooks treat it in more than an incidental fashion. No discussion of the history of bacteriology was known by the authors which was brief enough for use as an introduction to a course of bacteriology and at the same time sufficiently interesting to appeal to the student's imagination; yet, as a matter of fact, there is no way of arousing a student's interest in bacteriology than by giving him an account of the discoveries that led to its development. . . . One other matter that has not been handled in the conventional way is the inclusion of plant pathology in the part of the book dealing with animal and human diseases. The logic of this is evident; and the only justification for the usual arrangement of plant diseases with agricultural bacteriology is that the knowledge of them is of practical value to agricultural rather than to medical students. It is hoped that the plan adopted in the book will give the student the idea that animal and plant diseases are not, after all, so very different.

"The death of the senior author in the spring of 1917 made it necessary for the junior author to complete the work alone. At that time, however, the first draft of those sections which the senior author was writing was practically finished; so there is good reason to believe that the general plan of the book is essentially the same as it would have been had he lived to help in completing it. His death, together with the disturbances of the last few years, have, however, resulted in delaying its publication."

The first Part is devoted to general bacteriology, its history, and the activities of microorganisms; Part II. to non-pathogenic organisms, dairying, the soil, and miscellaneous industries, as the preservation of food, fermentation, and sera. Part III. treats of pathogenic organisms causing diseases, immunity, sanitation; water and sewage, plant diseases, both bacterial and fungus. Part IV. is an appendix treating of media-making, characterization of bacteria, and reaction of media and hydrogen ion concentration.

The author is to be commended for his carrying out of his task. His language is easy to follow, and, though he explains technical terms, he rarely uses them, so that not only students but others may readily understand the enormous influence exercised by these minute organisms upon human life and activities, direct or at second hand. The illustrations are the weakest part of the book; they are black and somewhat coarsely drawn. Pages 43 to 54 have been reprinted since the rest of the work was printed, presumably rewritten.

B. D. J.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.
[NINTH SERIES.]

No. 82. OCTOBER 1924.

XLII.—*Coleoptera: Ptinidæ and Anobiidæ of the Seychelles.*
By HUGH SCOTT, M.A., Sc.D., F.E.S., Curator in Entomology, University Museum of Zoology, Cambridge.

THIS paper is an account of the PTINIDÆ and ANOBIIDÆ obtained in the Seychelles Islands by the Percy Sladen Trust Expedition under Professor J. Stanley Gardiner in 1908–1909. It also contains descriptions of three new Indo-Malayan species, published here because they are very closely allied to a group of Seychellean forms. Excepting the cosmopolitan Anobiid *Lasioderma serricorne*, no member of either of these families has before been recorded from the Seychelles. In the Paris Museum I saw some Anobiids collected in the islands by Ch. Alluaud in 1892, but these had not previously been studied; they have now been worked out, and are included in this report. The Seychellean representatives of these families now amount to 3 species of PTINIDÆ, all referred to *Ptinus*, and 20 species of ANOBIIDÆ, belonging to 11 genera; these 11 genera fall into 3 out of the 8 subfamilies recognised in the recent catalogue (Pic, 1912) of ANOBIIDÆ, ANOBIINÆ being represented by 1 genus and 1 species, XYLETININÆ by *Lasioderma serricorne*, and DORCATOMINÆ by 9 genera and 18 species, three of the genera being described as new. All the species of both families (except *L. serricorne*) are described as new*.

* Of the three Indo-Malayan species included here, one belongs to a new genus well represented also in the Seychelles; the other two are placed in another new genus, not known from the Seychelles. They bring the total number of species dealt with in this paper up to 26.

Comparison with Faunas of other Islands.—As in the introduction to my last paper on Seychelles COLEOPTERA*, I give here a table of the numbers of genera and species of these two families found in several groups of remote islands, the faunas of which happen to have been well worked out:—

	PTINIDÆ.		ANOBIIDÆ.	
	Genera.	Species.	Genera.	Species.
Seychelles	1	3	11	20
Hawaiian Is.	—	—	6	138
Madeira	5	13	5	8
Canary Is.	7	20	7	19
Cape Verde Is. ..	4	4	(?) 3	3
St. Helena	1	1	(?) 2	5

The figures for the Hawaiian and Atlantic islands can only be taken as approximate. The sources of information used are 'Fauna Hawaiensis' and, for the Atlantic islands, the works of Wollaston on the several archipelagoes. I have also gone through Pic's Catalogues of PTINIDÆ and ANOBIIDÆ (both published in 1912) for additions to these faunas, but have not searched more recent literature. The number of genera given above for the Atlantic islands is sometimes doubtful, and does not always agree with the lists in the older works, owing to subsequent changes in, or doubt as to, the generic position of certain species. The outstanding fact is the great number of ANOBIIDÆ in the Hawaiian Islands, 134 out of the 138 species being accounted for by complexes of endemic forms belonging to 3 genera†, two of which are unknown and the third almost unknown from outside those islands. The only approach to this in the Seychelles is in the small complex of species belonging to the new genus *Nesotheca*, which, however, has a representative and close allies in the Indo-Malayan Region.

Localities and Distribution.—The Ptinids and Anobiids obtained by the Expedition were all collected in the mountainous islands of the Seychelles proper. All were taken by myself or by Mr. H. P. Thomasset; therefore no collectors' names are added to the detailed records. None were found in, nor have any to my knowledge been recorded from, the various groups of coral-islands in the same region. The species were nearly all obtained exclusively in the endemic forests which remain at considerable elevations in Silhouette and Mahé, or in the endemic forest of "Coco-de-mer" palms in Praslin: the only exceptions to this statement

* Trans. Linn. Soc. Lond. ser. 2, Zool. xviii. p. 196 (1922).

† *Holcobi* with 12, *Xyletobius* with 52, and *Mirosternus* with 70 species.

are (1) the cosmopolitan *Lasioderma serricorne*, not taken by the Expedition at all, but previously found by Brauer in Mahé, in cigars; (2) *Mirosternus alluaudi*, described from a single specimen taken by Alluaud in 1892 in the highly cultivated island of La Digue; (3) *Falsogastrallus seychellensis*, which was found in cultivated places near sea-level as well as at higher elevations. The other species were in many cases associated with the highest and dampest forest-areas, and this applies especially to *Nesothea*, *Metathea*, *Dorcatoma insulana*, etc.; several were found in fungi—e. g., *Metadorcatoma peculiaris*, *Dorcatoma insulana*, and many (if not most) of the species of *Nesothea*.

Affinities.—Of the three species of the world-wide genus *Ptinus*, *P. gothicus* certainly and possibly the others also seem to resemble Mascarene or Madagascar species; but there are many other described species, especially Oriental, which I have not seen, and I cannot say whether some of them may not also have affinities with the Seychelles species. Among the ANOBIIDÆ, the genus *Falsogastrallus* was erected for a Formosan insect, but *Gastrallus*, which it closely resembles in many points, appears to be known from most parts of the world. The Seychelles representative of *Petalium* closely resembles a Madagascar form of that very widespread genus. The Seychellean *Mesothus* appears to be very distinct from its congeners, which are known from Europe, Madagascar, and Japan. *Mesocælopus*, *Cænocara*, and *Dorcatoma* occur in most parts of the world; each has a single representative in the Seychelles, found under conditions which lead one to suppose that they are, respectively, endemic; remarks are made under each of these species about its relationship with its congeners, but it cannot be said at present that the Seychellean forms show a definite affinity with the species of any one region. The genus *Mirosternus* was known hitherto only from the Hawaiian Islands (the few Central American or Antillean insects subsequently placed in this genus being apparently referable elsewhere), in which it forms a complex of some 70 species; it is remarkable that there occur in the Seychelles two species which I can only place in this genus, though they exhibit certain anatomical features which probably do not occur in any of their Hawaiian congeners, and which may necessitate the erection of at least a distinct subgenus in the future. The species of the new genera *Metadorcatoma*, *Nesothea*, and *Metathea* are probably all endemic, though it is noteworthy that *Nesothea* has a representative in Tenasserim, while the two other Indo-Malayan species described below

are closely allied to *Nesotheca*, but are referred to the new genus *Paratheca*.

Anatomical Points.—The *hind wings* have been examined in every species except *Cænocara subplana* and *Mesothestenuibrachium*, and no cases of reduction or atrophy of these organs have been found. *Palpi* of remarkable form are described in *Mirosternus* and *Nesotheca* (pp. 371 and 387). The deep pits on the *metasternum* of *Nesotheca* are also worthy of note (pp. 388–390). This genus, moreover, exhibits a complex of species, some of which are indistinguishable by external characters, but which in the form of the *ædeagus* show remarkable constancy within each species, and striking differences between the species (figs., pp. 398–417). Two cases of variability in the *ædeagus*, consisting of the partial or entire doubling of a large spine, are figured (pp. 410, 413); and certain malformations of this organ, associated with the presence of NEMATODE worms, have come to light, but these latter must form the subject of a separate paper.

The types and a first set of all the new species will be placed in the British Museum, with the exception of *Mirosternus alluaudi*, the unique example of which is in the Paris Museum. A second set will be kept in the Cambridge Museum.

All the drawings were made by the writer, except those of the three species of *Ptinus*, which Mr. H. C. Gillings has kindly done. Antennæ, mouth-parts, legs, and *ædeagus* are always drawn from parts detached and mounted in balsam, except where it is otherwise stated. A drawing-apparatus has been used throughout.

It is a pleasure to express my thanks to the authorities of the British Museum, especially Mr. G. J. Arrow, and to those of the Musée d'Histoire Naturelle, Paris, particularly Mous. P. Lesne, for facilities granted me for working in those institutions and other help, and for the loan of duplicates; to Mr. G. C. Champion for the loan and gift of specimens for comparison; to Mr. Frederick Muir for advice on certain questions of anatomy; and to the Editors of the 'Annals and Magazine of Natural History' for accepting this paper.

Ptinidæ.

PTINUS, Linn.

1. *Ptinus gothicus**, sp. n.

Rufus, capite et interdum prothoracis basi nigricantibus, elytris

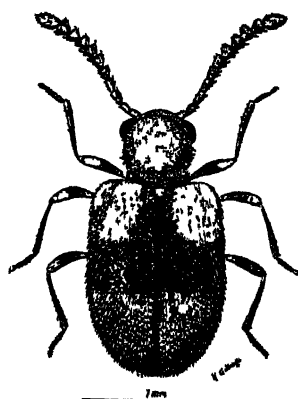
* Named in allusion to the seriate elytral punctures, which recall Gothic quatrefoils by their shape.

fasciâ nigricante, transversâ, latâ, in medio juxta suturam antice ad basin continuatâ; antennis sat curtis, rufis; corpore pilis sat sparsis, curtis, crassis, semi-decumbentibus vestito, his in prothorace et in partibus rufis elytrorum aureo-fulvis, in partibus obscuris elytrorum nigricantibus; scutello et maculis duabus in singulo elytro albo pubescentibus; prothorace æquo, lævi, nitido, postice profunde transversim canaliculato, ad marginem anteriorem et pone canaliculum fortiter punctato; elytris latis, humeris sat elevatis, regulariter profunde seriato-punctatis, punctis quadrifoliatis, intervallis subtiliter sparse punctulatis, interstitiis lævis.

Long. corp. ca. 1.5-1.75 mm.

General colouring red with darker markings and patches of white hairs; head blackish, thorax reddish-brown, in some specimens blackish behind the posterior constriction; elytra

Fig. 1.



Ptinus gothicus.

red, with a broad transverse dark band, the dark colour extending forwards rather broadly on either side of the suture and including the scutellum, there is also a slight and narrow darkening along the suture towards the apex; antennæ red-brown; legs red-brown with middle part of the femora darker, or, in one specimen, wholly blackish red except the tarsi, which are red-brown; underside of head and thorax dark reddish-brown, of abdomen red. The rather sparse, short, stout, semi-decumbent hairs are whitish on the posterior part of the head, yellowish in front (just above the bases of the antennæ); tawny-golden on the prothorax, paler behind, where the hairs converge on either side to form a kind of pencil; tawny-golden on the red parts of the elytra,

closer, thicker, white hairs: one on the scutellum, and two on each elytron, one being just behind the dark transverse band, a little nearer the suture than the outer side, the other being very scanty and small, on the anterior red part of the elytron, just where the dark colour of the transverse band is produced forwards; the antennæ have short, dark, stout hairs and fine pale hairs, the femora bear fine, closely adpressed, whitish hairs. Surface moderately shining. *Eyes* conspicuously large and prominent. *Antennæ* rather short, with segment 3 about $1\frac{1}{2}$ times as long as 2 and about $1\frac{1}{2}$ as long as 4; segments 3-9 about equal in length, increasing slightly in breadth till length and breadth are nearly equal; segment 11 about as long as 9 and 10 together, blunt at the apex. *Prothorax* with surface, except for the deep channelled posterior constriction, smooth and even; in front with large punctures rather far apart, interstices very finely punctulate; posterior part of disc (in front of the constriction) with no large punctures, only scanty fine points; behind the constriction with large punctures. *Elytra* about twice as wide as prothorax; shoulders moderately elevated; seriate punctures large, deep, less than their own diameter apart, and curiously shaped, appearing under a high power somewhat like "quatrefoils" in Gothic tracery; intervals finely and sparsely punctulate; interstices smooth; a very fine stria immediately adjacent to the suture. *Hind wings* normally developed. *Metasternum* with large, rather shallow punctures, sometimes less than their own diameter apart. *Ventral abdominal segments* with large but almost obsolete punctures; the first three segments fused together, and the sutures between them obliterated, in the middle. Front and middle *tarsi* with basal segment about equal in length to 2 and 3 together, 2, 3, and 4 very short, transverse, subequal in length, 5 about twice as long as 4; in the hind tarsi the basal segment is about equal to the three following together. Described from two specimens shown by dissection to be ♀, and three others of which the sex has not been determined.

Loc. Seychelles: Silhouette, Mahé. Silhouette: forest above Mare aux Cochons, over 1000 feet, xi. 1908, 2 examples. Mahé: country above Port Gland, 500-1000 feet, 5. ix. 1908, 1 example; Cascade Estate, about 800 feet or above, between x. 1908 and i. 1909, 2 specimens.

This species is referred to *Ptinus*, though it has certain structural characters not found in all members of that genus. Notably there is the fusion of the first three abdominal segments, but this character seems to arise in several different genera; it occurs in *Neoptinus*, Gahan, 1900, a genus erected

to contain one species from Christmas Island, though this has the antennæ only 9-segmented and differs from *Ptinus* in other respects; I have found the same fusion of the abdominal segments in *Xylodes albovaria*, Waterhouse, 1876 (Rodriguez)*, and see some indication of it in the almost cosmopolitan *Ptinus tectus*, Boield., though this latter has not been closely examined. Another remarkable feature of *P. gothicus* is the very large and prominent eyes; this occurs also, as stated by Pic, in two species described by him in 1901 from Mauritius, *P. cariei* and *P. atricornis*. I have examined specimens of both these at Paris, and find that *P. gothicus* is near them, but not identical with either. *P. atricornis* has the antennæ much longer and black, prothorax densely punctate and not shiny, elytra uniformly reddish, no golden hairs on prothorax or elytra, and the patches of white hairs quite differently distributed. *P. cariei* (one example, not in good preservation, seen) is bigger, has two elevations on the prothorax, golden hairs quite absent, and the white hairs on the elytra much more developed; its antennæ are shorter and reddish, approaching those of *P. gothicus*. *P. alluaudi*, Pic, 1896 (Madagascar), which I have not seen, is another small broad species, variegated with red and black, and having large prominent eyes; but several points in which it differs from *P. gothicus* are mentioned, and its antennæ (♂) are described as longer than the body.

2. *Ptinus monticola*, sp. n.

♂ ♀. Niger, nitidus, antennis nigris, pedibus fusco-rufis; prothorace elytrisq. pilis sparsis, curtis, tenuibus, decumbentibus, flavo-brunneis (inter hos aliquibus albis) vestitis, scutello dense albo pubescente, elytris plus minusve pubescentiâ albâ notatis; prothorace æquo, postice profunde transversim canaliculato, margine postico parum elevato, superficie omnino dense granulose punctato; elytris humeris sat acute elevatis, regulariter profunde seriato-punctatis, intervallis nitidis, sparse subtiliter punctulatis, parum rugulosis.

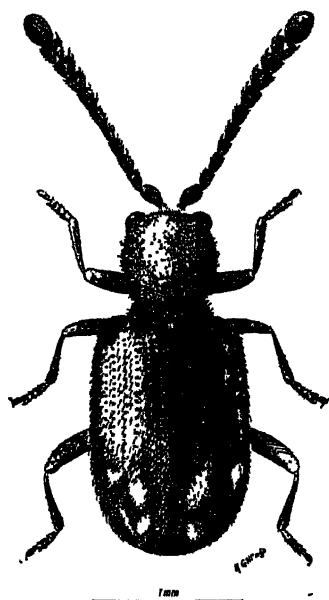
Long. corp. 2·25–fere 2·5 mm.

Entire body black, moderately shining; antennæ black; legs and tarsi dark reddish. Prothorax and elytra clothed with sparse, short, fine, decumbent, brownish-yellow hairs;

* In a footnote at the end of his Catalogue of PTINIDÆ (Col. Cat. part 41, 1912, p. 39) Pic expresses doubt whether this insect does not really belong to HYLOPHILIDÆ. I have several specimens before me, and find that the tarsi are not heteromerous, and the insect is a true Ptinid.

in addition there are white hairs, the distribution of which varies in different specimens; they are sprinkled very finely on head and prothorax; in the example figured (♂) they form a thick patch on the scutellum and several patches on each elytron, behind the shoulder, several on the posterior and apical part of the disc, and a few small flecks on the side at about the middle of the length; another example (sex undetermined) has, besides the patches, white hairs irregularly sprinkled all over the prothorax and elytra, rather

Fig. 2.

*Ptinus monticola* (♂).

thicker across a transverse band just behind the shoulders; a third specimen (sex undetermined) has no definite white patches except the scutellar, but has single white hairs and groups of three or four sprinkled all over the elytra. *Head* subopaque, granular. *Eyes* moderately prominent, not abnormally large. *Antennae* stout, seen under high power segment 2 is slightly longer than 3, 4 very slightly shorter than 3, 5 slightly longer, 5 and the following segments subequal in length, broadening gradually, terminal segment nearly as long as the two preceding together, blunt at the

apex. *Prothorax* with a deep posterior transverse constriction, and the actual hind margin slightly elevated; otherwise the surface is without elevations or depression, closely and granularly punctate, the elevated granules often almost contiguous. *Elytra* with shoulders rather acutely elevated, seriate punctures deep, regularly placed, those of each series close, intervals shining, sparsely and finely punctulate, and, seen under a high power, finely and reticulately striolate or wrinkled. *Hind wings* normally developed. *Metasternum* with large strong punctures and interstices finely and closely punctulate, the fine punctulation appearing granular at the sides. *Ventral abdominal segments* closely and finely reticulate-punctulate. Front and middle *tarsi* with basal segment about $1\frac{1}{2}$ times as long as segment 2, segments 2, 3, and 4 short, transverse, subequal in length, 4 rather broad, hollowed out above, and produced beneath into a lobe under the base of the terminal segment, which is about equal in length to 3 and 4 together; in the hind *tarsi* the basal segment is nearly as long as 2 and 3 together. The sex of two individuals, ♂ and ♀, has been determined by dissection, but no *external sexual differences* have been found, unless the variability of distribution of the white hairs, noted above, should prove, with larger material, to be partly sexual.

Loc. Seychelles: Silhouette, Mahé. Silhouette: near Mont Pot-à-eau, about 1500 feet, viii. 1908, 1 example. Mahé: high forest of Morne Blanc or Morne Pilot, about 2000 feet, xi. 1908, 1 specimen; forest of stunted "Capucin" trees (*Northea*) on summit of "Montagne Anse Major." 2000 feet or over, Mare aux Cochons district, i. ii. 1909, 2 examples. Only taken in the high areas of endemic forest.

Descriptions of many species have been consulted, especially those of Mascarene, Madagascar, and Oriental forms described by Pic, up to and including 1923, but *P. monticola* does not seem to be identical with any of them. I have before me an example of *P. metallicus*, Pic, 1897 (Mauritius), kindly lent from the Paris Museum (Coll. Alluaud); it has a brassy sheen which is absent in *P. monticola*, its antennæ are more slender towards the base, its femora are red in the basal third but otherwise blackish; the prothorax is narrower, somewhat swollen and gibbous in the middle, its granular punctures appear contiguous, the white hairs stouter and more conspicuous; the elytra have the shoulders less sharply elevated, the seriate punctures larger and closer, the intervals between the series narrower, the elytra in some

aspects appearing transversely wrinkled, and the white hairs are differently arranged, forming no thick patches except on the scutellum, but forming two transverse bands of not very close white hairs, one band just behind the shoulders, the other at about three-quarters the length from the base.

3. *Ptinus sechellarum*, sp. n.

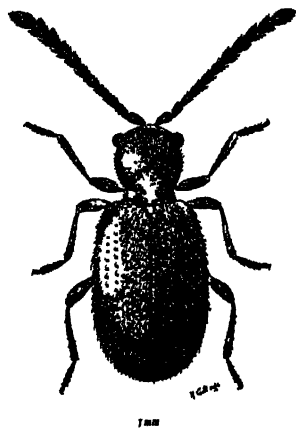
♂ ♀. Omnino niger, nitidus, antennis nigris, pedibus vel clare rufis, tarsis obscuris, vel plus minusve piceo-rufis; pilis sparsis, subtilissimis, curtis, semi-decumbentibus, brunnescentibus vestitus, capite pilis sparsis albis, prothorace postice maculâ mediâ, conspicuâ, dense albo pubescente, scutello dense albo pubescente, elytris pilis albis aliquibus, rarissimis, in partis lateralibus; prothorace æquo, postice transversim profunde constricto, punctis raris (præcipue in parte posteriore disci), interstitiis in medio disci lævis, impunctatis, sed ad marginem anticum plus minusve, pone sulcum transversum fortiter, granulosis; elytris humeris modice elevatis, punctis seriatis modice magnis, haud valde approximatis, intervallis lævis, remote subtiliter punctulatis.

Long. corp. ca. $1\frac{1}{2}$ –2 mm.

Entirely black and shining; antennæ black; legs varying from light red with dark tarsi to dark pitchy-reddish. The general hairy covering of the body consists of sparse, very fine, short, semi-decumbent brownish hairs; on the sides of the prothorax there are stouter, more erect hairs, which appear yellowish-white in some specimens, quite dark in others; scattered fine white hairs on the head; a patch of dense, pure white pubescence on the posterior part of the disc of the prothorax, extending over the transverse furrow to the hind margin, and another such patch on the scutellum; and a few white hairs scattered singly or in very small groups on the outer parts of the elytra. *Eyes* prominent, not exceptionally large. *Antennæ* rather stout, segment 3 nearly $1\frac{1}{2}$ times as long as 2, 3 and 4 about equal in length, 5 slightly longer and subequal in length to the following segments, terminal segment less blunt at apex than in the preceding species, about 1.7 times as long as the preceding segment. *Prothorax* with a deep posterior transverse constriction, otherwise even; punctures moderately large, not very close (often several times their own diameter apart), smaller and rarer on the posterior part of the disc; the interstitial surface is smooth, shining, and impunctate in the middle and posterior parts of the disc, more or less rough and granular near the front margin in some specimens, and very rough and granular behind the transverse constriction. *Elytra* with shoulders less elevated than in the preceding

species; seriate punctures moderately large, circular, not very close, those in a series being often about twice their own diameter apart; intervals between the series quite smooth and shining, each with a row of very fine hair-bearing punctures, wide apart; there are also other very fine hair-bearing punctures in the interstices between the punctures of each series, one fine puncture usually lying just anterior to each large puncture of the series. *Hind wings* normally developed. *Metasternum* finely and closely punctulate, with a few larger subobsolete punctures and a small posterior median impression. *Ventral abdominal segments* finely and closely reticulate-punctulate. *Tarsi* relatively narrow, segment 4 being produced into a lobe beneath the base of

Fig. 8.

*Ptinus sechellarum.*

segment 5 but not much broadened, and segments 2, 3, and 4 being relatively long; in the front tarsi the basal segment is only about $1\frac{1}{4}$, in the middle tarsi $1\frac{2}{3}$, in the hind tarsi about $1\frac{3}{4}$, as long as segment 2; terminal segment less than $1\frac{1}{2}$ times as long as the preceding.

Sexual differences: the sex of several individuals has been determined by dissection; the ♂ has the abdomen ventrally a little more flattened in front, and the margins of the 2nd segment more nearly straight, especially the hind margin, which curves forward markedly in the middle in the ♀.

Loc. Seychelles: Silhouette, Mahé. Silhouette: near Mont Pot-à-eau, probably about 1500 feet, viii. 1908,

1 example. Mahé: above Port Glaud, 500–1000 feet, xi. 1908; near Morne Blanc, and high forest of that mountain, 1000–2000 feet, x.–xi. 1908; Cascade Estate and forest above, about 1000 feet and over, i.–iii. 1909; Mare aux Cochons District, 1000–2000 feet, i.–ii. 1909; the examples from Mahé number 19, 16 of these being from Cascade.

None of the species which I have seen, nor those occurring in circumjacent regions, and the descriptions of which I have read, appear very closely to resemble *P. sechellarum*. *P. madagascariensis*, Pic, 1903, an example of which was examined at Paris, is a smaller insect, with prothorax and elytra more strongly and rugosely punctured, no white pubescent patch at the base of the prothorax, legs black, and body covered with semi-erect, yellowish, seriate hairs.

Anobiidæ.

ANOBIINÆ.

FALSGOASTRALLUS, Pic, Suppl. Ent., No. 3, p. 10 (Jan. 1914).

This genus is distinguished from *Gastrallus* on account of the antennæ being 9-, not 10-, segmented; the prothorax being explanate at the sides, and having the keeled lateral margin complete, not dying away some distance from the front margin; also by the prothorax being attenuated in front, the abdomen "inexcavate," the elytra with a single lateral stria, and the form of the body less elongate.

The genus was erected to contain *Falsogastrallus sauteri*, Pic (*l. c.*), from Formosa. Not having seen this insect, I refer the following species from the Seychelles to the genus with some hesitation. But it appears to agree with the description of the genus in all important characters. It has 9-segmented antennæ; the lateral keels of its prothorax are almost complete, but do not quite reach the front margin, though they extend much further forward than in the European *Gastrallus immarginatus*, Duval (which I have used for comparison); *F. seychellensis* also has the prothorax distinctly explanate at the sides behind and narrowed in front; its front and middle coxæ are wider apart than in *G. immarginatus*, the mesosternum forming quite a wide plate (with raised margins) between the middle coxæ; its elytra have a single lateral stria, and its form is proportionately shorter than in *G. immarginatus*.

Pic does not mention the shape of the scutellum in *F. sauteri*, only stating "écusson moyen, bien visible," but in *F. seychellensis* this part is very short and transverse,

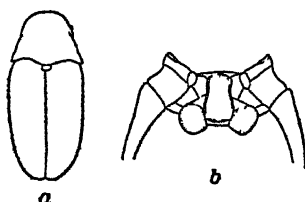
contrasting with the much longer scutellum in *G. immarginatus*, and this may constitute a useful generic, or at least specific, character.

4. *Falsoastrallus seychellensis*, sp. n.

Suboblongus, postice obtusus, obscure brunneus, antennis pedibusque brunneo-testaceis, nitidus, pubescentiâ brevissimâ, tenuissimâ, decumbente, sericatâ, vestitus: prothorace antice angustato, lateribus postice expansis, basi eâ elytrorum distincte latiore, margine basali elevato, marginibus lateralibus carinatis, fere ad marginem anteriorem attingentibus, superficie dense subtilissime punctulato, punctis majoribus, subobsoletis, postice in medio dorsi et in lateribus deflexis crebrioribus; scutello valde transverso, postice subtruncato; elytris fere parallelis, postice obtuse separatim rotundatis et margine apicali parum explanato, striâ laterali unâ a humero ad $\frac{2}{3}$ longitudinis attingente, callo subhumerali modice elevato, disco dense subtilissime reticulato et punctulato, et punctis majoribus crebris munito.

Long. corp. 1.4-1.75 mm.*

Fig. 4.



Falsoastrallus seychellensis.

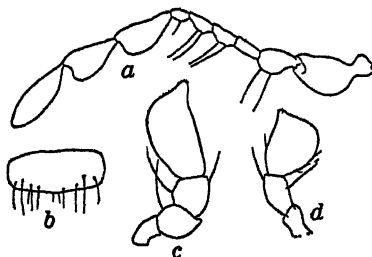
a, outline, $\times$ ca. 14; *b*, mesosternum and cavities (shaded) of middle coxæ (the lines in the side-parts of the figure represent both sutures and ridges), $\times$ 33.

Suboblong, bluntly rounded at the posterior end, narrowed anteriorly, uniformly very dark brown, with antennæ and legs brownish-testaceous, shining, covered with excessively short, closely decumbent, whitish pubescence, which gives a silky appearance to specimens in good condition. *Head* very closely and finely punctulate. *Antennæ*, see fig. 5 *a*. *Labrum* (fig. 5 *b*) strongly transverse, with front margin subtruncate. *Mandibles*, detached and mounted in balsam, presenting the same general form as those figured in certain *DORCATOMINÆ* (see figs. 11, 16, 19); the apical tooth is

* Measurements in this and all succeeding species are made from specimens with the head retracted, and therefore do not include the head.

short and rather blunt, the subapical tooth also blunt. *Maxillary* and *labial palpi* shown in fig. 5 *c, d*, of the same type as those of *Gastrallus* *. *Prothorax*, seen from above, narrowed to the front, with the deflexed lateral parts expanded behind, so that the prothorax at its base is distinctly wider than the base of the elytra; dorsum convex, sloping down behind to the hind margin, which is elevated (less so towards the sides), slightly curved backwards in the middle and shallowly sinuate on either side; seen from the side, the hind angle appears very much greater than a right angle and rounded off at the apex, the lateral marginal keel

Fig. 5.

*Falsogastrallus seychellensis*.

a, antenna, $\times 50$; *b*, labrum; *c*, maxillary palp; *d*, labial palp.
b, c, d, all $\times 175$.

is distinctly arcuate and (in ventro-lateral view) is seen to extend forwards about $\frac{2}{3}$ of the distance from hind to front margin; the entire surface is exceedingly finely and closely punctulate, and there are larger subobsolete punctures on the middle of the dorsum, more numerous on the deflexed lateral parts, absent on the front of the dorsum. *Scutellum* strongly transverse, subtruncate behind. *Elytra* nearly parallel-sided, but slightly narrowed from about the middle forwards to the base, bluntly rounded behind, where the outline does not form a continuous curve, but is slightly bent inwards at the suture, and the apical margin of each elytron is very slightly explanate; subhumeral callus moderately well-marked; seen in side view there is a single well-defined lateral stria close to the margin, extending forward to the shoulder, dying away behind at about $\frac{2}{3}$ the length of the

* The labium and labial palp of *G. immarginatus* are figured by Reitter, 'Fauna Germanica, Käfer,' iii. pl. cxxi. fig. 8b (1911); the palp is of the same type as that of *F. seychellensis*, but has the segments much more elongate.

elytron from the base; a very fine subsutural stria can be traced forward almost to the scutellum; the entire surface is exceedingly closely and finely punctulate and reticulate, and there are larger punctures scattered irregularly, fairly close (often about twice their own diameter apart). *Hind wings* fully developed. *Prosternum* of remarkable form, only fully visible when the head, prothorax, and hind body are separated from one another; between the widely separated front coxæ it forms a wide, very short bridge, widely sinuate and fringed with hairs behind; in front of this bridge is a deep concavity, lying transversely, spindle-shaped and pointed at the ends, with raised margins, and in front of this is a very short anterior portion, lying almost in a vertical plane, while the posterior bridge lies in a horizontal plane. *Mesosternum* forming between the middle coxæ a suboblong plate, slightly narrower and with its sides slightly sinuate in front of the middle, with raised margins, and with surface slightly excavated in front, closely and strongly punctured behind. *Metasternum* convex, with a fine median longitudinal furrow in the posterior half, and the hind margin between the coxæ very shallowly angularly excised; meta-episterna rather broad, widening very much from the hind to the front end; surface with larger punctures, not very close, and interstices very finely and subreticulately punctulate. The fused 1st and 2nd *ventral abdominal segments* are longer than the three following segments taken together; segment 3 very short; 4 and 5 slightly longer, subequal in length; all closely and finely punctulate. Balsam-preparations show that the *tarsi* are all normally 5-segmented, the basal segments being more elongated in the middle and hind pairs than in the front, while in all three pairs the basal segment is about equal in length to the two following together.

Loc. Seychelles: Mahé, Long Island, La Digue. Mahé: Cascade Estate and forest above, about 1000 feet, mostly i.-iii. 1909, 41 examples; Port Victoria, 1 specimen. Long Island: vii. 1908, 1 specimen. La Digue: 1892, 1 example (*Alluaud*, in Paris Museum). The occurrence of this species at Port Victoria and in Long Island indicates that it is not confined to the endemic forests in the mountains.

Falsogastrallus sauteri, Pic, is described as considerably larger and seems to differ also in other respects, the lateral stria of the elytra being described as "presque complète." *Gastrallus javanus*, Pic, 1903, is described as larger, and "niger"; I have not seen a specimen and cannot say more exactly what is the relation of this species to *F. seychellensis*.

Gastrallus cucullatus, Lesne, 1902 (Ceylon), which I have seen at the Paris Museum, is much longer, narrower, and less shiny, its prothorax is quite differently shaped, having a transverse down-sloping ridge on each side in front near the front angles and the hind angles quite acute.

XYLETININÆ.

LASIODERMA, Stephens.

5. *Lasioderma serricorne* (Fabr.) ; Kolbe, Mitt. Zool. Mus. Berlin, v. 1910, p. 27.

Loc. Seychelles. Mahé, found in cigars (*A. Brauer*). This cosmopolitan species was not obtained by the Percy Sladen Trust Expedition.

DORCATOMINÆ.

PETALIUM, J. Leconte.

6. *Petalium thomasseti* *, sp. n.

Suboblongum, fere parallelum, obscure ferrugineo-brunneum, pedibus ferrugineis, antennis pallidioribus ; capite prothoraceque opacis, elytris ægre nitidis, corpore crinibus tenuissimis, brevibus, pallidis, decumbentibus vestito ; prothorace antice fortiter angustato, rotundato-acuminato, postice dilatato et ad latera parum expanso, superficie fere æquâ, densissime punctatâ ; elytris a basi ad circa $\frac{3}{4}$ longitudinis lateribus subparallelis, postice angustatis, apice obtuse rotundato, callis subhumeralibus vix prominulis, superficie seriato-punctatâ, interstitiis et intervallis rugulosis et punctis subtilissimis confusis munitis.

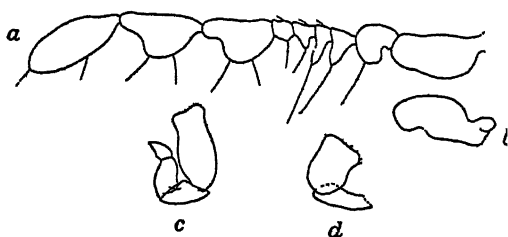
Long. corp. ca. 1.6 mm.

Suboblong, nearly parallel-sided, very dark ferruginous-brown, with legs a little less dark ferruginous and antennæ (except the basal segment) rather light ferruginous-brown ; head and prothorax opaque, elytra slightly shining, the whole body above covered with very fine, short, pale, decumbent hairs. *Head* very closely punctured, the punctures large, rather shallow, almost contiguous, and with a fine point in the centre of each. *Antenna* shown in fig. 6 a (differences have been remarked in the form of the segments in different species of this genus). *Maxillary* and *labial palpi* shown in figs. 6 c, d ; their last segments are truncate at the distal

* Dedicated to Mr. H. P. Thomasset, who helped me greatly in collecting insects in the Seychelles, and who was at that time (1908) owner of Cascade Estate, Mahé, where the specimens were found.

extremity, but in some of the species examined in the British Museum these are deeply emarginate in the middle and appear distinctly "two-fingered." *Prothorax* (seen from above) strongly narrowed in front, so that the front margin appears almost produced to an apex in the middle, widened and a little expanded at the sides behind, but with the surface much more even than in some species, so that the sides do not appear concave; seen from the side, the hind angle is definite but greater than a right angle, the lateral carina is slightly sinuate behind and is complete (continuing forward to the front margin), and the deflexed lateral portion near the front angle is rather strongly impressed; hind margin slightly elevated and the entire surface very closely punctate, the punctures a little smaller than those on the head and contiguous. *Scutellum* subrectangular, about

Fig. 6.

*Petalium thomasseti*.

a, right-hand antenna (from a carded specimen), $\times 50$; *b*, basal segment of antenna in a different position (balsam-preparation), $\times 50$; *c*, maxillary palp, $\times$ ca. 147; *d*, last two segments of labial palp (last segment somewhat foreshortened, owing to sloping upwards in the balsam), $\times$ ca. 147.

as long as broad. *Elytra* nearly parallel-sided for about $\frac{3}{4}$ the length from the base, then narrowed considerably to the rather blunt posterior extremity; also narrowing very slightly towards the shoulders, just behind which the reflexed lateral margins are visible from above; subhumeral calli only slightly marked; a very fine subsutural stria can be traced under a high power forward nearly to the scutellum; the whole surface is finely rugulose and bears very fine scattered punctures; the larger seriate punctures are circular and those of each series are separated from one another by a distance equal to two or more times their own diameter. *Hind wings* fully developed. Side-parts of prothorax beneath with a rather deep impression; intercoxal

part of *prosternum* with about eight long fine setæ on its hind margin. *Metasternum* with its big anterior lobe very finely and very closely punctate; just behind this lobe the metasternal punctuation is coarser, larger, and subrugulose with fine short decumbent hairs; posterior part of *metasternum* with punctuation almost obsolete and surface glabrous, except for a transverse series of larger punctures along the hind margin. *1st ventral abdominal segment* with its forward-projecting median part rather coarsely punctured, remainder of this and the other ventral segments very fine and closely punctured.

Loc. Seychelles. Mahé: Cascade Estate, about 1000 ft., i. 1909, 2 examples.

In the Paris Museum I have seen the typical form of *P. alluaudi*, Pic (1905), and its var. *obscurior*, both from Madagascar, but I doubt whether they are not really two quite distinct species. *P. thomasseti* is very like *obscurior*, Pic, but has the thorax wider and more expanded at the sides and is a slightly broader insect altogether; its prothorax is duller and perhaps a little more closely punctured than that of *obscurior*. I was not able to examine the underside or minute anatomical characters of *obscurior*. I saw at Paris another species described by Pic (1903) from Madagascar, *P. bifeveolatum*; the specimens were placed under the synonym *Fossanobium bifeveolatum*, Pic, 1905, and possibly there were two closely allied species among them; all were, however, quite distinct from *P. thomasseti*. Pic has further described (Mélanges, xxxvi. 1922, p. 7), from Réunion (Bourbon), a new genus and species, *Petalanobium auratum*, which I have not seen; but from the description it appears much larger and otherwise different from the Seychelles insect. Several of the Neotropical species of *Petalium* have also been examined, including the specimens in the British Museum of the forms discussed by Champion, Trans. Ent. Soc. London, 1913, pp. 139–142, but all are quite distinct from *P. thomasseti*. As remarked above, in the description of the latter, the species present anatomical differences in the form of the antennæ and palpi, as well as differences in the shape of the prothorax, sculpture, etc.

Mesotheres, Mulsant et Rey.

7. *Mesotheres tenuibrachium*, sp. n.

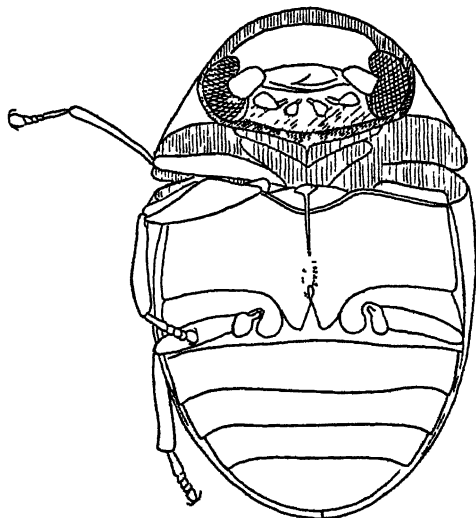
Breviter ovalis, convexus, piceo-ferrugineus, prothorace rufescente, antennis, palpis, pedibus anticis, fulvescentibus, pedibus intermediis atque posticis piceo-ferrugineis; nitidus, pubescentiâ tenui,

decumbente, supra pallide fulvâ, vestitus; prothorace subtilissime creberrime punctato, interstitiis lævis, lineâ subbasali tenui, angulis anticis (de latere visis) deflexis, acutis, posticis late obtusis, rotundatis; elytris fortiter creberrime punctatis, interstitiis lævis, callo subhumerali fere nullo, striâ submarginali unâ, in tertiâ parte anteriore longitudinis obsoletâ, striâ subsuturali tenuissimâ, antice obsolescente; metasterno convexo, medio postice sulcato, antice carinato, hoc et segmentis abdominis creberrime punctatis; pedibus anticis conspicue gracilibus.

Long. corp. ca. $1\frac{1}{2}$ mm.

Form short-oval, very convex. Colour dark pitchy-ferruginous, the prothorax lighter, more reddish than the

Fig. 7.



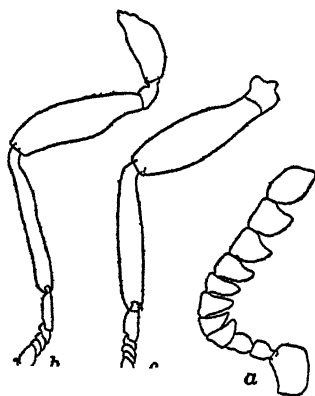
Mesothus tenuibrachium.

Underside, legs only shown on one side, head and prothorax somewhat pulled away from hind body, $\times 45$.

elytra; the slender front legs tawny-yellowish, contrasting markedly with the darker, pitchy-ferruginous middle and hind legs; antennæ and palpi tawny-yellowish. Body shining, closely covered with fine, decumbent, pale tawny or whitish pubescence. Head closely and finely punctured. Eyes slightly emarginate on the inner side. Antennæ (fig. 8a) with basal segment very large, subrectangular, segments 2 and 3 small, longer than broad, not produced inwardly, 4-10 produced inwardly, 4-8 being much broader than long,

9 and 10 nearly as long as broad, 11 about $1\frac{1}{2}$ times as long as broad. *Maxillary palpi* with terminal segment broadened, emarginate at apex; in the *labial palpi* it has not been possible to examine its exact form*. *Prothorax* with front angles much deflexed and very sharp, hind angles widely obtuse and rounded off; produced backwards in the middle at the base, in a wide curve, and with a fine subbasal marginal line; very finely and closely punctured, the punctures appearing from one to several times their own diameter apart. *Scutellum* about as long as broad at the base, gradually narrowed from the base, rounded at the apex, extremely finely punctured. *Elytra* closely covered with much larger punctures, not in the least rugulose, with no trace of seriate

Fig. 8.

*Mesoths tenuibrachium.*

a, antenna (setæ and portion of basal segment which articulates with head not shown); *b*, left front leg; *c*, left middle leg (coxa not shown). All $\times 50$.

arrangement, frequently about their own diameter apart or even less; with a very fine subsutural stria, extremely close to the suture, and becoming obsolete in the anterior part; with a single, rather vague, submarginal stria, reaching from the apex to about the level of the posterior coxæ; with almost no subhumeral callus; and (seen in side-view) with the humeral angle widely rounded off and margin sinuate just

* In a specimen before me of *Mesoths ferrugineus*, Muls. et Rey, from Besika Bay, Asia Minor, determined by Schilsky and kindly lent me by Mr. G. C. Champion, both pairs of palpi have the apical margin of the terminal segment very shallowly sinuate.

behind the hind coxæ. *Hind wings* not examined. *Prosternum* with the median longitudinal carina, characteristic of the genus, in front of the contiguous front coxæ. *Middle coxæ* widely separated. *Metasternum* closely punctured and very convex; in front the convex elevated portion is bounded by a fine raised ridge, which is widely sinuate between the middle coxæ; in front of this ridge on either side is a declivous concave portion of the metasternum, which receives the folded middle leg in repose; the sinuate median part of the ridge is crossed at right angles by a median longitudinal keel, which projects forward beyond the ridge and terminates in front in an expanded head; dorsal to this forward-projecting part of the keel is seen a lamina with widely arcuate front margin (in the example of *M. ferrugineus* mentioned in the footnote this lamina is strongly reflexed—i. e., bent ventralwards—along its front margin); behind, the longitudinal keel dies away before the middle of the metasternum, and is succeeded by a deep longitudinal sulcus; between the rather widely separated *hind coxæ* the metasternum is produced into two short diverging processes; meta-episterna narrow, narrowing in front when seen in side-view. *Hind coxæ* with plates gradually widening outwards, a characteristic of the genus, as is also the condition of the 1st ventral abdominal segment, which is almost hidden by the coxæ, but has its hind-marginal part visible as a narrow strip; segment 2 slightly longer than 3 or 4, which are equal in length; 5 nearly as long as 3 and 4 together; all the segments are closely and rather strongly punctured, and a slight flattening is apparent in the middle of the 3rd and 4th. *Front legs* (fig. 8 b) very slender, contrasting strongly with the middle and hind pairs (fig. 8 c); front tibiæ and tarsi especially slender, which causes the tarsi in some positions to look remarkably dilated and clubbed towards the apex. In all the pairs of *tarsi*, the basal segment is nearly as long as the four following segments taken together.

Loc. Seychelles, Silhouette: Mare aux Cochons, over 1000 feet, ix. 1908, 1 specimen.

This species seems to be so distinct from its congeners by its minute size, very short-oval form, and slender front legs, that I have little hesitation in describing it, even from a unique example. *M. brevipennis*, Pic, 1903 (Madagascar), which I have seen in the Paris Museum (Coll. Alluaud) is quite different, being a much larger, proportionately longer, more nearly parallel-sided insect. *M. pulverulentus*, Reitter, 1877, from Japan, appears to be totally different from

M. tenuibrachium, being described as 3-4 mm. long, oblong, and subparallel.

MESOCÆLOPUS, Jacquelin du Val.

8. *Mesocælopus silhouettæ*, sp. n.

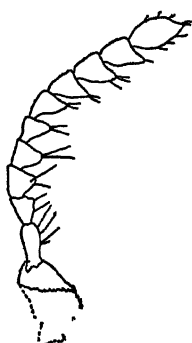
Sat longe ovatus, piceo-brunneus, prothorace antice et elytris postice fulvescentibus, antennis et pedibus anticis fulvis, pedibus aliis piceo-rufis; nitidus, pubescentiâ tenni, decumbente, pallide fulvâ, vestitus; prothorace disco haud gibboso, creberrime subtilissime punctato, lineâ subbasali tenui; elytris callo subhumerali haud fortiter elevato, disco creberrime punctato, punctis majoribus, circularibus, haud profundis, inter puncta subtilissima sparsis, striâ subsuturali, tenui, ad suturam approximatiâ, antice obsolescente; metasterno sat elongato, lobo anteriore brevi, fere ut in *M. nigro* formato, apice obtuso, parum reflexo, post hunc utrinque elevato.

Long. corp. ca. 2 mm.

Rather elongate-ovate, the prothorax and elytra, viewed from above, having a regular unbroken outline when the parts are retracted. Dark pitchy-brownish, the darkest colour being at the base of the elytra and extreme base of the prothorax, the posterior part of the elytra and the prothorax in front of the extreme base becoming tawny yellowish or reddish; antennæ and anterior legs tawny ferruginous, intermediate and posterior legs and ventral abdominal segments dark pitchy-reddish, metasternum pitchy-black. Upper surface very shining, and body covered above and below with very fine, closely decumbent, pale tawny or yellowish pubescence (more whitish on the underside). *Head* closely and very finely punctured. *Antennæ* (fig. 9) with segment 2 over twice as long as broad, not produced on the inner side, 3 nearly $1\frac{1}{2}$ times as long as broad, slightly produced inwardly, 4-10 are much produced inwardly, the produced part in 9 and 10 being directed obliquely slightly distalwards; 4, 5, and 6 are a little broader at the apex than long, in the more distal segments the length increases. *Palpi*: viewed under the highest power applicable to the whole insect, the maxillary palpi have their terminal segments rather broad, subtruncate at the apex, the labial palpi have it much dilated, with apical margin oblique, very shallowly sinuate, produced at the inner angle. *Prothorax*, seen in side-view, with front angles much deflexed and inflexed, very acute, hind angles considerably larger than a right angle and rounded off at the

apex; seen from above, it has the base a little produced backwards in the middle* and slightly sinuous on either side, with a very fine subbasal line immediately in front; the disc is not in the least gibbous, but forms a curve quite continuous with that of the clytra, it is very closely and extremely finely punctured, the punctures appearing about once to twice their own diameter apart, and the interstices smooth. *Scutellum* about as long as wide at the base, gradually narrowing from the base, widely rounded at the apex, excessively finely punctulate. *Elytra*, seen in profile, with the humeral angle widely rounded, and the deflexed lateral portion vaguely impressed just behind the shoulder; seen from above, with a slight, but definite, subhumeral callus, and with (on each separate elytron) a vague, elongate,

Fig. 9.

*Mesocelopus silhouette.*

Antenna (part of basal segment broken away), $\times 50$.

postero-lateral impression, some little distance before, and to one side of, the apex, and above the lateral margin, with which the impression is nearly parallel; with a fine sub-sutural stria, extremely close to the suture, and traceable right forward to the scutellum, though almost obsolete right in front; disc extremely closely punctured, with very fine punctures only about their own diameter apart, and rather numerous, much larger, shallow, circular punctures scattered among them, apparently without trace of scriate arrangement. *Hind wings* fully developed. *Metasternum* closely punctured, with punctures of unequal size; it is decidedly

* Appearing subtruncate when viewed from behind, where the base of the scutellum interrupts very slightly its outline.

longer than that of *M. niger*, but its short blunt anterior lobe is of much the same size and form as that of *M. niger*, with the apex slightly reflexed (*i. e.*, bent ventralwards) and two small elevations side by side behind this; the metasternum is somewhat elevated in the middle, and has a small, very vague, shallow, central impression. *Ventral abdominal segments* very closely punctured with rather large punctures, less than their own diameter apart; 2nd (*i. e.*, first visible) segment slightly longer than 3 and 4, which are subequal, 5 nearly as long as 3 and 4 together; the segments are rather strongly arched, *i. e.*, convex transversely, 5 sloping rather steeply dorsalwards.

Loc. Seychelles. Silhouette: Mare aux Cochons or the forest above, over 1000 feet, viii. and ix. 1908, 2 examples.

This species differs widely from the European *M. niger*, Germ., in its smaller size, more shining surface and finer pubescence, in the total absence of any gibbosity on the disc of the thorax, and in its less marked subhumeral calli on the elytra, in the presence of punctures of two quite distinct sizes on the latter, in the greater length of the metasternum, etc. *M. indicus*, Pic (1914), appears from the description too short and broad; *M. castelsi*, Pic (1922, India), is not adequately described for comparison; *M. sumatrensis*, Pic (1904), is said to be "nigro-piceus," and seems to be distinct. *M. babaulti*, Pic (Bull. Soc. France, 1922, p. 239), from East Africa, is described as about the same size or slightly smaller; the description is inadequate for close comparison, but I have little doubt that *M. babaulti*, which is described as "niger, aliquot pro parte rufescens," is distinct from *M. silhouette*. *M. subattenuatus*, Pic, 1903, from Madagascar (examined in the Paris Museum), has its elytra slightly more attenuated behind, with the subapical impression scarcely marked, the dorsal punctuation slightly, and metasternal punctuation considerably, stronger than in *M. silhouette*. *M. rufithorax*, Pic, 1904 (Congo), appears from the description to be quite distinct.

MIROSTERNUS, Sharp.

The two following species are referred to *Mirosternus* on account of their resemblance in general form and structure to the Hawaiian members of the genus. In general shape, number of antennal segments, structure of sterna, abdominal segments and tarsi, and in the absence of striæ or seriate punctuation on the disc of the elytra, there is close similarity between the Hawaiian and Seychelles

species. But among the long series of Hawaiian *Mirosternus* in the British Museum are a number of specimens, belonging to several species, with the palpi exposed, and in all these cases the terminal segment is entire, not excised as are both maxillary and labial palpi in the two species described below; this character may possibly be regarded in the future as necessitating the erection of a separate genus, or at least a subgenus, for the Seychelles species. In specific characters there is plenty to differentiate the latter from the Hawaiian insects; they are smaller than any of those in the British Museum, while the form of the antennal segments, sterna, and of the scutcheon-like, elevated, median part of the basal abdominal segment also present points of difference.

This genus was described by Sharp in 1881 from the Hawaiian Islands, where it forms a large complex of species, 70 being enumerated by Perkins in 'Fauna Hawaiiensis' (iii. p. 614). Four species from Central America or the Antilles are referred to *Mirosternus* in Pic's Catalogue of Anobiidæ (1912), but Champion (Trans. Ent. Soc. London, 1913, p. 142) considers that three of them, described by Gorham, should be placed in *Eupactus*. They appear to be, at any rate, distinct from *M. seychellensis* and *M. alluaudi*. It is probable, therefore, that, with the exception of the two latter, *Mirosternus* is confined to the Hawaiian Islands. Since the publication of Pic's catalogue no new species appear to have been described.

9. *Mirosternus excisipalpis*, sp. n.

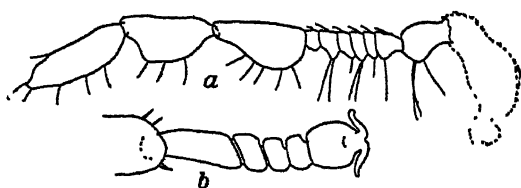
Suboblongus, piceo-niger, pedibus rufo-piceis (tarsis pallidioribus), antennis segmento basali ac clavâ rufo-piceis, segmentis intermediiis testaceis; corpore pubescentiâ decumbente griseo-vel flavo-albidâ vestito; antennis segmento basali magno, 2 subpyriformi, intus magis producto et setis longis munito, 3 æque longo ac apice lato, basi angustato, intus ad apicem parum producto et setâ longâ munito, 4-7 valde transversis, 5 et 7 intus parum magis productis et setis longioribus munitis, 8 curto sed angustiore, 9-11 clavam magnam, segmentis omnibus reliquis æquilongam, formantibus; palpis maxillaribus et labialibus segmento ultimo apice dilatato et ad angulum externum profunde emarginato; prothorace transverso, antrosum angustato, lateribus (desuper visis) perparum sinuatis, angulis anticis (de latere visis) valde deflexis et acutis, posticis obtusis, basi in medio postice productâ, ante scutellum subtruncatâ, margine basali perparum elevato, disco dense subtilissime punctato; elytris lateribus fere parallelis, omnino estriatis, callo subhumerali

sat elongato, superficie densius subtilissime punctatâ; metasterno in lobum curtum, latum, antice arcuatum inter coxas intermediâs productum, superficie nec sulcatâ nec carinatâ; segmento basali ventrali abdominis parte mediâ elevatâ scutiformi, fere æque latâ ac longâ, lateribus parallelis, antice arcuatâ.

Long. corp. circa 2 mm.

Suboblong; body uniformly pitchy-black, legs reddish-pitchy, tarsi lighter, antennæ with basal segment and the three club-segments dark reddish-pitchy, the small intermediate segments lighter, testaceous; body not strongly shining, closely covered with decumbent greyish-white or yellowish-white pubescence. *Head* very finely and closely punctured, strongly convex in the middle, with the front margin declivous, with a ridge on either side running obliquely forwards from near the inner anterior part of

Fig. 10.



Mirosternus excisipalpis.

a, antenna (basal segment represented dotted because detached in the preparation, if attached it would be turned in a slightly different plane), $\times 85$; *b*, middle tarsus, dorsal view, $\times$ ca. 147.

the eye to the front margin, the middle part of the latter being very shallowly sinuate, almost truncate. *Eyes* rather prominent, large, but separated by a distance equal to nearly three times the breadth of one eye*. *Antennæ* as shown in fig. 10 *a*; in repose the large basal segment lies against the front of the eye; segments 3, 5, and 7 are slightly more produced on the inner side, and bear longer and stronger setæ than the other segments of the funicle; segments 4-7 are very short and strongly transverse, 8 is short, but much narrower. *Labrum* (fig. 11 *a*) short, transverse, subtruncate in front. *Maxillary* and *labial palpi* (fig. 11 *c*, *d*), with the terminal segment broad at the apex

* The size of the eyes and distance between them are treated as important characters by Perkins in distinguishing the Hawaiian species.

and deeply emarginate near the outer angle ("two-fingered," as in the labial palpi of *Nesotheca*, gen. nov.). *Prothorax* transverse, narrowed, but not greatly produced over the head to the front, appearing (when viewed from directly above) very slightly sinuate at the sides; in side-view the front angles are seen to be very much deflexed and very acute, and the hind angles obtuse; at the base the prothorax is produced backwards in the middle, and is subtruncate in front of the scutellum, and the basal margin is very slightly elevated; the entire surface is very finely and closely punctured, the punctures being separated by a distance about equal to, or but little greater than, their own diameter. *Scutellum* about as long as its breadth at the base, sides nearly parallel towards the base, hind margin arcuate; its surface with some excessively fine points.

Fig. 11.

*Mirosternus excisipalpis*.

a, labrum; *b*, mandible; *c*, right maxillary palp; *d*, left labial palp.

All $\times$ ca. 147.

Elytra nearly parallel-sided, entirely without striæ, with a somewhat elongated subhumeral callus, and with the entire surface finely and very closely punctate, the punctures scarcely stronger than those on the prothorax, and separated by a distance only about equal to their own diameter, or even less; there is no trace of seriate arrangement, and the interstices are smooth. *Hind wings* fully developed. *Prosternum* constructed as in one of the Hawaiian species which is before me; the coxæ are widely separated and projecting, and the prosternum forms between them a short broad intercoxal process, rather widely sinuate and a little produced at the angles behind. As in other members of the genus, the *mesosternum* is completely concealed when viewed from directly below, and is recessed under the metasternum. *Metasternum* produced forwards between the middle coxæ as a short broad lobe with slightly elevated

and widely arcuate front margin, and produced on either side into a ridge, behind which is a curved groove for the reception of the tibia and tarsus of the middle leg; hind part of metasternum very closely and finely punctured and pubescent at the sides, the punctures are sparser over a small space in the middle, and there is no median sulcus or carina, at most a slight vague depression behind. *Ventral abdominal segments* very finely and closely punctured and pubescent; the elevated middle part of the basal segment, which projects forward behind the hind coxæ, is nearly as broad as long, has parallel sides with finely elevated margins, and is arcuate in front; the terminal segment has its hind margin rather broadly reflexed. The *middle tarsus* is shown in fig 10 b; the long slender basal segment, short, obliquely transverse, intermediate segments, and enlarged terminal segment are characteristic of all the pairs of tarsi, and occur in other members (Hawaiian) of the genus which I have examined.

Loc. Seychelles: Silhouette, Mahé, Praslin. Silhouette: near Mont Pot-à-eau, about 1500 feet, and Mare aux Cochons, over 1000 feet, viii. 1908. Mahé: near Morne Blanc, about 800 feet, xi. 1908; Cascade Estate, about 1000 feet. Praslin: Côtes d'Or Estate, xi. 1908. 15 examples in all.

10. *Mirosternus alluaudi*, sp. n.

Major, conspicue latior, pubescentiâ erectâ; prothorace et elytris subtilissime et densissime punctatis, his subrugulosis, dorso parum deplanato; metasterno lobo anteriore antice minus arcuato; segmento 1° abdominis parte mediâ elevatâ angustiore, de extremitate anticâ ad posticam gradatim angustata, margine anteriore arcuato.

Long. corp. ca. 2.3 mm.

Distinguishable at once from *M. excisipalpis* by its larger size, much broader form, and erect pubescence. Pitchy-blackish, shining, legs and underside of body reddish, antennæ brownish-testaceous. The specimen being unique, it has not been possible to make microscopic preparations of antennæ and palpi; under the highest power available, the *antennæ* are seen to be 11-segmented, and the form and proportions of the segments appear closely similar to those of *M. excisipalpis*; both *maxillary* and *labial palpi* have their terminal segments excised at the apex and of the "two-fingered" kind, though perhaps less markedly so than in the preceding species. *Prothorax*, seen from above, very short, its front and side margins forming a nearly continuous curve; seen from the side, the hind angle is definite, but

greater than a right angle, the lateral carina continues forward to the front margin, the front angle is deflexed and acute; the entire surface is closely and finely punctured, the punctures being only about their own diameter apart. *Scutellum* subpentagonal, its sides parallel. *Elytra* with dorsum rather flattened, subhumeral calli moderately prominent, and only an excessively fine subsutural stria discernible; the entire surface is as finely and closely punctured as that of the prothorax, without trace of seriate arrangement, and has indications of rugulosity. *Hind wings* fully developed. *Prosternum* with its intercoxal portion widely and shallowly sinuate behind, without hairs on the hind margin. *Metasternum* with the front margin of its anterior lobe forming a slightly more flattened curve than in *M. excisipalpis*; entire surface of the metasternum finely and closely punctate; the median longitudinal suture is clearly marked, but vanishes at the front end. *1st ventral abdominal segment* with its elevated median portion (which projects forward between the hind coxæ) considerably narrower than in *M. excisipalpis*, markedly narrowing from its front to its hind end, and strongly arcuate in front; all the visible ventral segments are finely and very closely punctate, the punctures being often not more than about their own diameter apart, and the pubescence rather long, as on the upper surface of the body. *Tarsi* of the form characteristic of the genus.

Loc. Seychelles: La Digue, 1892, one example (*type*) in Paris Museum, collected by Ch. Alluaud.

CÆNOCARA, Thomson.

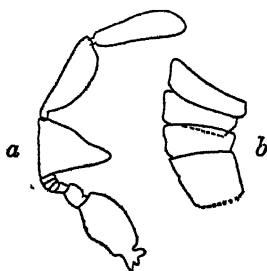
11. *Cænocara subplana*, sp. n.

Curta, lata, dorso parum depresso (haud concavo); nitida, nigra, supra pilis erectis, tenuibus, pallide flavescentibus parciissime vestita, antennis ferrugineis, segmento basali parum obscuriore, pedibus piceo-ferrugineis, tarsis minus obscuris; prothorace disco fortiter sat parce, basi crebrius seriatim, punctatis; elytris striis 2 lateralibus, profunde impressis (intervallo transverse convexo), antice ad circiter $\frac{1}{2}$ longitudinis elytrorum evanescentibus, postico striâ exteriori fere ad suturam continuatâ, inferiore magis abbreviatâ, callo subhumerali conspicuo elevato, parum elongato, disco parce fortiter punctato, basi transverse, intervallis inter striis lateralibus longitudinaliter, seriatim punctatis, striâ subsuturali tenuissimâ, haud impressâ, ad scutellum continuatâ; metasterno et segmentis ventralibus abdominis fortiter sat dense punctatis.

Long. corp. 1.5 mm.

Short and broad, rather flattened (but not concave) dorsally in the region of the scutellum. Shining black, with very sparse, fine, erect, pale yellowish hairs (closer on the lower surface), antennæ ferruginous, the basal segment darker but not black, legs pitchy-ferruginous, the tarsi lighter reddish. *Head* rather strongly but sparsely punctured. *Eyes* with the deep incision reaching nearly to the hind margin, where it tapers to a point. *Antennæ* shown in fig. 12. *Prothorax*, seen from the side, with front angles much produced downwards, acute, hind angles much larger than a right angle, rounded off just at the apex; seen from above, very transverse, the sides and front margin forming an almost regular curve, the base much produced backwards in the middle and bisinuate on either side; strongly but rather sparsely punctured, the punctures two, three, or considerably more times their own diameter apart in the middle,

Fig. 12.

*Ctenocara subplana*.

a, antenna, $\times 50$; *b*, segments 3-6 of antenna, $\times 265$.

rather closer on the deflexed lateral parts and along the margins, especially along the base, where they form a fairly regular series (there is no subbasal stria), the interstices quite smooth. *Scutellum* subtriangular, about as long as broad at the base, with a few minute punctures. *Elytra*, seen in side-view, with humeral angle definite, larger than a right angle, the lateral margin shallowly sinuate just behind the humeral angle and narrowly reflexed throughout its length; with two lateral striæ, deeply impressed (the interstice between them being transversely convex), both ending in front at about the level of the hind end of the callus, i. e., about $\frac{1}{2}$ the length of the elytron from the base, the outer stria extending back parallel to the margin nearly to the suture, the inner stopping some distance short of

this; the third stria, within these two, is represented only by a short series of impressed, slightly elongate punctures, level with the posterior part of the callus and extending back a little behind it; subhumeral callus sharply elevated and rather elongate; an exceedingly fine subsutural stria is discernible, extending forward to the scutellum; on either side of the scutellum the margin of the elytron is very slightly elevated; punctures on the disc strong but sparse, often three or more times their own diameter apart; they are closer and form fairly regular series along the base and along the intervals between the inner and outer stria, and between the outer stria and the margin; the interstices are quite smooth, and the fine erect hairs on the disc show some trace of seriate arrangement. *Hind wings* not examined. *Meta-sternum* and *ventral abdominal segments* closely and strongly punctured, the punctures only about their own diameter (or frequently less) apart; no trace of fine interstitial punctuation, interstices quite smooth; 2nd (first visible) ventral segment a little longer than 3rd; 4th in the middle a little shorter than 3rd, owing to its hind margin being subangularly curved forwards in the middle; 5th about as long as 3rd and 4th together.

Loc. Seychelles. Silhouette, Mahé, Praslin. Silhouette: near Mont Pot-à-eau, about 1500 feet, viii. 1908; Mare aux Cochons and forest above, over 1000 feet, ix. 1908. Mahé: near Morne Blanc, 800 feet or above, x. 1908, 1 specimen. Praslin: Côtes d'Or Estate, xi. 1908, 1 example. 8 specimens in all.

This species is much smaller than the European *C. bovistæ*, Hoffm., and its dorsal surface is much more sparsely punctured and has the pubescence longer, sparser, and more erect; moreover, it has only two lateral striæ on each elytron, and these are not continued in the front $\frac{1}{2}$ of the length. *C. boleti*, Alluaud (1900), from Madagascar (examined at the Paris Museum), is considerably larger, has the humeral calli less sharply prominent and the dorsum of the elytra rather more convex, the punctures a trifle smaller and with some indication of arrangement in series on the elytra, and a third stria inside the other two at the base of the elytra. *C. weisei*, Schilsky, 1898 (E. Africa), is much larger than *C. subplana*, and differs in the nature of the striæ and punctuation on the elytra, and of the punctuation on the underside, etc. *C. rufitarsis*, Reitt., 1878 (= *Dorcatoma granulum*, Kiesenw., 1879), from Japan, of which I have examined a specimen from the British Museum, is also decidedly larger, with tibix and basal segment of antennæ

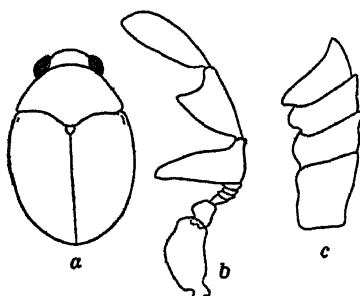
darker, prothorax and elytra much more closely punctured, while the two outer lateral striæ of the elytra extend forward to the humeral angle, and a third impressed stria is present within these, abbreviated just behind the callus. *Dorcatoma nigrina*, Boheman, 1851, from the Limpopo River, appears from the description to be referable to *Cænocara*, but not agreeing in specific characters with the Seychelles insect.

DORCATOMA, Herbst.

12. *Dorcatoma insulana*, sp. n.

Breviter ovata, convexa, modice nitida, pilis tenuibus, erectis, griseo-vel flavo-albidis, in elytris subseriatis, sat dense vestita; obscure ferruginea, prothorace rufescente, antennis segmento basali ferrugineo, segmentis intermediis testaceis, clavâ infuscatâ,

Fig. 13.



Dorcatoma insulana.

a, outline, head protruded, $\times 33$; *b*, antenna, $\times 50$;
c, segments 3-6 of antenna, $\times 265$.

pedibus obscure ferrugineis, tarsis pallidioribus; prothorace crebre subtilissime, in medio disci rarius, punctato, lineâ subbasali nullâ; elytris callo subhumerali modice elevato, striis 2 lateralibus, impressis, antice fere ad basin, postice fere ad suturam (striâ inferiore quam exteriore vix brevior), continuatis, striâ subsuturali subtilissimâ, antice ad $\frac{1}{2}$ longitudinis elytrorum evanescente, disco arcis angustis, longitudinalibus, impunctatis, intervallis dense fortiter punctatis (punctis majoribus et minoribus); metasterno haud sulcato, dense, in medio fortius, punctato; segmentis abdominalibus dense subtilissime punctatis. Long. corp. $1\frac{1}{2}$ - $1\frac{3}{4}$ mm.

Shortly ovate, very convex; dark ferruginous-reddish, prothorax a little lighter; antennæ with basal segment dark

ferruginous, minute funicular segments testaceous, club-segments darkly infuscated; legs dark ferruginous, tarsi lighter; body moderately shining, thickly covered with fine, erect, greyish-white or yellowish-grey hairs, subseriately arranged on the elytra. *Head* closely and finely punctured; *eyes* subangularly prominent at the sides, the anterior emargination reaching about $\frac{1}{2}$ of their length*; *antennæ* shown in fig. 13 *b, c*; the very short segments 4-6 are slightly produced on the inner side, especially the 6th. *Prothorax*, seen from the side, with anterior angles much produced downwards and very sharp, hind angles much greater than a right angle and rounded off; seen from above, the prothorax is very transverse, strongly narrowed to the front, with sides slightly arcuate and the base produced backwards in the middle, with no subbasal line; disc very finely punctured, the punctures at unequal distances in the middle of the disc, about two to six times their own diameter apart and with quitesmooth interstices; at the sides and towards the base the punctures are closer and the surface slightly rugulose. *Scutellum* about as long as broad at the base, shield-shaped, with acute apex, and surface with rather numerous minute punctures. *Elytra*, seen from the side, with humeral angle very obtuse and rounded off, and with two impressed lateral striæ, both extending forward almost to the base, and extending behind almost to the suture, the inner one being scarcely shorter than the outer; subhumeral callus moderately elevated; there is an extremely fine subsutural stria, very close to the suture, and disappearing in about the anterior $\frac{1}{2}$ of the length; on the disc there are narrow, longitudinal, impunctate spaces (with a faint trace of striæ visible under a high power); between these the punctures are close, often less than their own diameter apart, they are of unequal size, some being more than twice the size of others, and the larger ones being very much bigger than those on the prothorax; interstices smooth; the erect hairs are subseriately arranged, there being longitudinal series of hairs directed slightly forwards, and those on the intervals between these series leaning backwards. *Hind wings* fully developed. *Prosternum* widely sinuate behind between the front coxæ and fringed with long hairs, also with about three very long hairs rising from the front end of its median longitudinal carina. *Metasternum* with no median sulcus or pit, closely punctured throughout, the punctures at the sides being finer, those in

* In a rather small and badly preserved example (which I at first placed as a different species but which I believe to be only a variety) the emargination appears slightly deeper.

the middle large and separated by less than their own diameter. *Ventral abdominal segments* closely but very finely punctured, 2nd (first visible) segment slightly longer in the middle than 3 or 4, which are equal in length, 5 being as long as 3 and 4 together; in the specimen examined (sex undetermined) the hind margins of 3 and 4 are regularly arcuate and parallel the one to the other, but the hind margin of 2 is subangularly curved forward in the middle.

Loc. Seychelles. Silhouette, Mahé. Silhouette: near Mont Pot-à-eau, 1500 feet and over, vii.-viii. 1908, including 10 specimens bred with other beetles and a small Ichneumonid* from fungus found in the highest and dampest forest, about 2000 feet, 29. vii. 1908; Mare aux Cochons and forest above, over 1000 feet, ix. 1908. Mahé: country above Port Glaud, about 500-1000 feet, 5. xi. 1908, 1 example; near Morne Blanc, about 1000 feet, xi. 1908; high forest of Morne Blanc and Morne Pilot, about 2000 feet, xi. 1908, 5 specimens; and 16 other specimens from fungus found in the high jungle. 48 examples altogether, all from the endemic forests at high altitudes, and more than half of them from fungus.

In comparison with forms like *chrysomelina* and *flavicornis*, the shortly ovate and convex (almost subglobose) form and erect pubescence of the present species at once arrest attention. The anterior emargination of the eye is considerably deeper than in either of those European species, nevertheless I think the Seychelles insect is referable to this genus rather than to *Cænocara*. The only example of the European *D. setosella*, Muls., which I have seen, is considerably larger and more oblong than the Seychelles species, and its pubescence, though erect, is shorter. *D. lanata*, Fauvel, 1904, from New Caledonia, appears from the description to be larger than *D. insulana* and quite differently shaped.

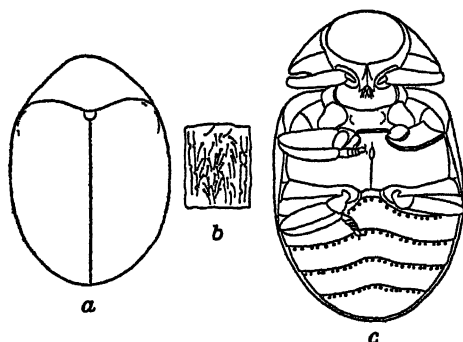
METADORCATOMA, gen. nov.

Corpus curtum, ovoideum, valde convexum, pubescentiâ sat densâ, brevî, erectâ vestitum. Caput infra haud excavatum, supra fere planum, antice haud deflexum. Oculi magni, antice perparum sinuati. Antennæ 11-segmentatæ, breves, segmento 1 magno, 2 intus valde sed obtuse producto, 4-8 brevissimis, transversis, intus serratis, 5 intus in processum longum producto, 9-11 clavam laxam formantibus. Mandibulæ magnæ, fere quadrangulares, subtus sat concavæ. Palpi maxillares segmento

* *Thersilochus evanescens*, Morley, Trans. Linn. Soc. ser. 2 (Zool.), xv. p. 178 (1912).

ultimo triangulari, apice subtruncato; labiales segmento ultimo late triangulari, apice extus sinuato. Prothorax brevis, basi elytris angustior, de basi ad marginem anteriorem valde angustatus, lateribus (desuper visis) haud sinuatis, basi in medio fortiter postice arcuatâ. Scutellum scutiforme, apice acuto. Elytra callis subhumeralibus modice prominulis, striâ suturali tenui fere obsoletâ, disco striis 10 (in utroque elytro) crenulatis munito; margine externo ad genua postica recipienda haud exciso, sed late haud profunde sinuato. Coxæ anticæ sat late separatæ; prosternum processu intercoxali modice lato, apice sat profunde et acute bifido. Mesosternum, capite et appendicibus retractis, invisum, medio postice profunde excavatum et sub lobo anteriore metasterni recessum. Metasternum lobo anteriore

Fig. 14.



Metadorcatoma peculiaris.

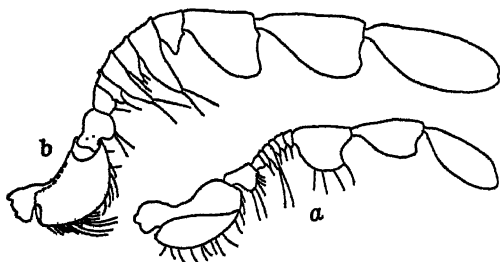
a, outline, $\times 12$; *b*, fragment of surface of elytron showing parts of two striæ, $\times 50$; *c*, underside (head removed, also tibiæ and tarsi of both front legs and one hind leg, and whole of one middle leg; prothorax drawn away from hind body; lines on mesosternum represent ridges, not sutures), $\times$ ca. 14.

brevi, antice recte truncato et marginato, inter coxas intermedias productum; parte posteriore sulco longitudinali medio, antice foveolato, instructum. Coxæ posticæ processu abdominali sat late separatæ, laminis extus gradatim dilatatis. Segmenta visibilia abdominis 5, ultimum quam quartum vel tertium longius. Femora omnia infra ad tibiâs recipiendas sulcata. Tarsi omnes 5-segmentati, segmento basali extus laminato, tribus sequentibus simul sumptis fere æquilongis, his brevissimis, ultimo parum longiore.

Form short, ovoid, strongly convex; body covered with fairly dense, short, erect pubescence. *Head*, when retracted, received into the prothorax and bent back so that the mandibles touch the anterior lobe of the metasternum; not

excavated beneath behind the mentum; nearly flat dorsally between the eyes, not deflexed in front, but with a deep transverse furrow (? the fronto-clypeal suture) between the bases of the antennæ, and with a groove on either side running along the inner margin of the eye and forwards to the extremity of the transverse furrow; clypeus very short and transverse, with front margin widely sinuate (see fig. 16 *b*). *Eyes* large, very slightly sinuate in front; the outer portion of each eye is received within the prothorax when the head is retracted; when it is extended, most of its lateral outline is formed by the eyes, which are subangulate in front. *Antennæ* (fig. 15 *a*) short, 11-segmented; 1st segment very large (recalling that of *Anitys*), laterally compressed and flattened on the posterior side; 2nd strongly but bluntly produced on the inner side, 3rd about as long as broad at the distal end, 4-8 very short and transverse, produced

Fig. 15.

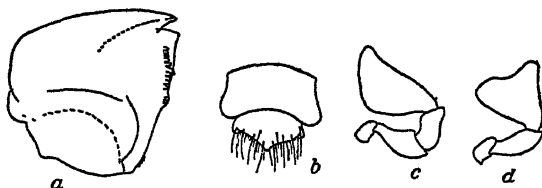


a, antenna of *Metadorcatoma peculiaris*, $\times 50$; *b*, antenna of *Theca denticornis*, Champion, for comparison, $\times 50$.

inwardly so as to give a serrate appearance, 5 being produced into a long process bearing two long setæ (this recalls the processes on the intermediate segments in the Indian *Stagetus* [= *Theca*] *denticornis*, Champion, 1919, the antenna of which is figured, fig. 15 *b*, for comparison); 9-11 forming a loose club. *Labrum* (fig. 16 *b*) very small, short, transverse, widening slightly from the base, with distal margin widely angular and acuminate at apex. *Mandibles* (fig. 16 *a*) very large, almost quadrangular, rather concave ventrally. *Maxilla* with distal parts of galea and lacinia covered densely with bristly hairs, nearly as in *Nesothea* (cf. fig. 19 *c*); the hairs are nearly all curved over at the apex, especially on the lacinia; palp (fig. 16 *c*) with terminal segment triangular, subtruncate at distal extremity. *Labium* nearly as in *Nesothea* (cf. fig. 19 *d*); palp (fig. 16 *d*) with

terminal segment broadly triangular, at distal extremity sinuate towards the outer angle, arcuate at the inner angle. *Prothorax* short, strongly curved backwards in the middle at the base, narrower than the elytra at the base, strongly narrowed from base to front margin, not sinuate at the sides when viewed from above; lateral margins deflexed, not visible from above, the sharp marginal ridge running right from the very wide hind, to the acute front, angle. *Scutellum* scutcheon-shaped, about as long as its breadth at the base, with sharp apex. *Elytra* with moderately prominent subhumeral calli, with a trace of a fine sutural stria and 10 other, very distinct, crenulate striae; the three outer striae (on the deflexed lateral part of the elytron) are deeper than the rest, the second discal stria (from the suture) is strongly curved inwards at the base to the apex of

Fig. 16.

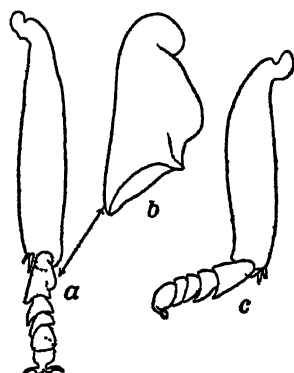
*Metadorcatoma peculiaris.*

a, left mandible from dorsal side, hairs not shown, the series of small blunt "teeth" are seen through the translucent chitin of the inner edge; *b*, labrum and clypeus; *c*, maxillary palp; *d*, labial palp. All $\times 85$.

the scutellum, the first discal stria is abbreviated at the base, and there is no short scutellar stria; seen in profile, the humeral angle is very wide and obtuse, the lateral margin just behind this is very slightly sinuate to receive the knee of the middle leg, and further back it is widely sinuate, but not sharply excised to receive the knee of the hind leg. *Hind wings* normally developed. Structure of the *underside* nearly as in *Dorcatoma* or *Anitys*: *front coxae* rather widely separated, intercoxal process rather wide and short, but rather deeply and sharply bifid and furnished with long setae at the extremity; the prosternum also has a median longitudinal ridge, from near the front end of which rises a long seta. *Mesosternum* not visible when the parts are retracted, deeply recessed and hidden by the anterior lobe of the metasternum, as in *Dorcatoma*, etc. *Metasternum* (fig. 14 *c*) with

a short broad anterior lobe separating the middle coxæ; this lobe is squarely truncate and has an elevated margin in front, and is obliquely truncate at either of its lateral angles, which project very little on either side; posterior part of metasternum with a narrow and shallow median longitudinal furrow, deepened into a small pit at its front end; epimera very narrow, almost linear, but broadening a little at the level of the hind end of the metasternum. *Hind coxæ* with laminæ broadening towards the outer extremity, separated by a short and broad intercoxal process of the abdomen. *1st ventral abdominal segment* excavated to receive the folded hind legs, scarcely visible when these are retracted; segments 2-5 convex, 2-4 approximately equal

Fig. 17.

*Metadorcatoma peculiaris.*

a, right front tibia and tarsus from ventral side, $\times 50$; *b*, basal segment of same tarsus, $\times 175$; *c*, left middle tibia and tarsus, $\times 50$.

in length, 5 considerably longer. *Legs* with femora grooved beneath to receive the tibiæ; *tarsi* (fig. 17) all 5-segmented, basal segment about as long as 2-4 together, the latter very short, terminal segment rather longer; the basal segment has a curious laminate expansion on its outer side, as shown in fig. 17 *a, b* (whether this is confined to one sex could only be determined with certainty by dissection of the genitalia of several examples; the expansion is present in all the specimens, some eight in number, which have the legs set out). When the parts are retracted the front and middle legs are not packed away quite as in *Nesothea*; in that genus the front tibiæ are concealed beneath the middle legs, but part of the front femora is visible (*cf.* fig. 20); in *Metadorcatoma*

the front tibiæ are visible (but conceal the front femora), packed just in front of the middle femora.

On a superficial examination of the dorsal surface and striate elytra, the insect for which this genus is erected has some resemblance to certain species of *Theca*; the antenna also has the same number of segments as in that genus, and, as remarked above, its curious form recalls that of the Indian *Theca denticornis*, Champion (in which, however, the funicular segments are much more serrate, and both the 5th and 7th are produced into long processes). But closer study shows that the structural characters are much more nearly those of *Dorcatoma*; in the form of the prothorax, head, mandibles, and eyes (though these last are only very feebly sinuate in front in *Metadorcatoma*), in the separated front coxæ and form of the pro-, meso-, and metasterna, *Metadorcatoma* has strong points of resemblance with *Dorcatoma*. *Metadorcatoma* seems to differ clearly from all the other genera, both those of which I have examined representatives and those of which I have only read the descriptions. Several others (besides *Theca*) have striate elytra: but, of these, the North American *Byrrhodes*, Leconte, has, according to Fall (Trans. Amer. Ent. Soc. xxxi. 1905, p. 263), the antennæ 9-segmented, and the prosternum broadly truncate-emarginate and without processes behind, though the metasternum is much as in *Dorcatoma*; *Protheca*, Leconte, has (also according to Fall, *op. cit.* p. 259) the head deeply excavated beneath, and the front coxæ nearly contiguous, the intercoxal process being pointed; *Stichtoptychus*, Fall (*op. cit.* p. 258), is elongate-oval, more like *Catorama*, and has the head deeply excavate for the antennæ, the metasternal lobe deflexed, etc.; *Stagetomorphus*, Pic (Mélanges, x. p. 7, 1914), based on an Indian insect, is said to have a very large scutellum and the thorax explanate at the sides and behind, and, though the antennæ and sterna are not described exactly, the insect is said to be near *Stagetus* [*Theca*]. *Metadorcatoma* must be regarded as a genus having strong points of resemblance to *Dorcatoma* structurally, but possessing striate elytra, which are not found in the latter genus, and further characterized by the form of its antennæ.

Type of the genus: *Metadorcatoma peculiaris*, sp. n.

13. *Metadorcatoma peculiaris*, sp. n.

Brunnea, nitens, pubescentiâ fulvescente, antennis (basi exceptâ) et tarsorum apicibus rufo-fulvis; capite subtilissime punctulato, interstitiis lævis; prothorace granulato-punctato, interstitiis subtilissime punctulatis, basi haud marginatâ; elytrorum striâ

unâquâque in utroque latere crenulatâ, intervallis dense subtiliter punctatis, punctis aliquibus perparum fortioribus.
Long. corp. ca. 2.8 mm.

Body and legs uniform dark brown, antennæ (except the basal segment) and apices of tarsi lighter, reddish-fulvous, underside of body more reddish; pubescence tawny-yellowish; surface of body shining. *Head* between the eyes very finely punctured, the punctures at varying distances, from one to about 5 or 6 times their own diameter apart; interstices quite smooth. *Prothorax* with the base not margined; disc granulate-punctate, the granulate appearance being produced by larger punctures bearing stronger hairs and surrounded by an elevated crater-rim; these larger punctures are scattered from about once to three times their own diameter apart, and the interstices bear extremely fine punctures, from which arise very fine, shorter hairs, and which are usually two to three times their own diameter apart. *Scutellum* smooth and impunctate. *Elytra* with the fine sutural stria very faintly marked and obsolete in the anterior part; the discal striæ each have minute crenulations projecting into them at irregular intervals along each side (fig. 14*b*), and in some aspects the shadows behind these crenulations give the striæ the appearance of being punctate; the intervals are all finely and closely punctate, the punctures being from one to two or three times their own diameter apart; slightly stronger punctures, bearing longer and stronger hairs, are scattered among the rest, and especially along the sides of each interval, close to the edges of the striæ; the general surface between the punctures appears under a high power in some aspects minutely uneven, almost rugulose. *Metasternum* and *ventral abdominal segments* very finely and closely punctured and pubescent, the punctures appearing under a high power of more than one size, especially on the metasternum: there is a series of elevated round granules across the extreme base of each abdominal segment from the 2nd to the 5th inclusive.

Loc. Seychelles. Silhouette: Mare aux Cochons plateau and forest above, over 1000 feet, viii.-ix. 1908, 6 examples (most or all of which were almost certainly taken from fungus); 10 specimens from fungus, ix. 1908, exact locality and elevation not recorded.

CHARACTERS OF THE GENERA *NEOTHECA*, *METATHECA*,
AND *PARATHECA*.

The following three genera, all described as new, agree closely in many respects, but differ in certain anatomical

characters. *Nesotheca* and *Metathea* are erected to include a complex of Seychellean forms; *Parathea* is constituted to contain two Indo-Malayan species so closely allied to the Seychelles insects that it has seemed best to describe them in this paper (for the same reason I have included here a single Indo-Malayan species of the genus *Nesotheca*). These three genera all have a considerable resemblance to *Theca* in superficial appearance, but differ from it in the number of segments in the antenna, the absence of striæ on the disc of the elytra, the form of the sterna, and other points. They all form extremely compact little pilules when the parts are retracted; all are clothed with decumbent, light-coloured pubescence; the pronotum has punctures of two sizes, fine punctulation occupying the interstices between the larger punctures; the elytra have regular series of large punctures and the fine intervallar punctulation is frequently of two sizes; the mesosternum is invisible when the parts are retracted; the metasternum has an anterior lobe which is a modification of the anvil-shaped kind, and which always bears a deep pit filled with hairs; the posterior part of the metasternum also usually has a deep median groove, or a second deep pit filled with hairs, or both, but this pit and groove are less constant than the pit on the anterior lobe. No more need be written here, as the anatomy is fully discussed under the genera, especially under *Nesotheca*. The genera may be briefly differentiated as follows:—

A. Antennæ 10-segmented.

- a. Maxillary palpi with two deep excisions ("three-fingered"), labial palpi with one ("two-fingered"), at the apex of their terminal segment. [Ædeagus of ♂ dorso-ventrally flattened, median lobe either subtruncate or produced into two horns at the angles distally, internal sac bearing a pair of large spines.] NESOTHECA, p. 386.

- a'. Maxillary and labial palpi with their terminal segment entire at the apex. [Ædeagus very differently formed, see figures and description below.] METATHECA, p. 418.

- B. Antennæ 9-segmented. Palpi with their terminal segment entire at the apex. [Ædeagus constructed much as in *Nesotheca*, but without the two spines on the sac.] PARATHECA, p. 423.

Nesotheca and *Metathea* agree in the number of antennal segments, but differ in the form of the palpi and ædeagus; *Metathea* and *Parathea* agree in the form of the palpi, but differ in the number of antennal segments and the form of the ædeagus; *Nesotheca* and *Parathea* agree in the general

plan of the ædeagus, but differ in the form of the palpi and the number of the antennal segments.

NESOTHECA *, gen. nov.

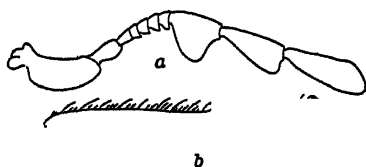
Corpus suboblongum vel ovoideum, pubescentiâ brevi, decumbente, griseo-albidâ vel griseo-flavâ vestitum. Caput infra pone mentum ad antennis recipiendas profunde excavatum. Oculi nec emarginati nec sinuati. Antennæ 10-segmentatæ, segmentis 5-7 intus parum serratis, 8-10 clavam laxam formantibus. Palpi maxillares segmento ultimo apice dilatato, profunde bi-emarginato; labiales segmento ultimo apice profunde emarginato. Prothorax a basi ad apicem gradatim angustatum, lateribus (desuper visis) leviter sinuatis. Scutellum lateribus arcuatis, sed interdum ad apicem subacutum convergentibus. Elytra callo subhumerali plus minusve conspicuo, vel interdum subobsoleto, instructa; haud striata, sed fortiter seriato-punctata; margine externo ad genua postica recipienda sat profunde sinuato. Coxæ anticæ subcontiguæ; hæ, et mesosternum (capite cum appendicibus retractis), invisæ. Metasternum ad tibiae tarsosque medios recipiendos utrinque transversim profunde canaliculatum, lobo antico incudiformi profunde triangulariter foveato, foveâ densissime pilosâ; pars posterior metasterni foveâ alterâ mediâ, vel magnâ vel minutâ, densissime pilosâ, munita. Abdomen segmentis visibilibus 5, secundo processum inter coxas posticas formante, suturis segmentorum anteriorum medio sinuatis. Femora omnia infra ad tibiae recipiendas sulcata.

Form suboblong or ovoid, upper surface covered with dense, short, decumbent, greyish-white or yellowish pubescence; body always unicolorous, reddish-black or blackish. The whole structure is arranged to allow of a complete retraction of the head and appendages. *Head* received into the prothorax, declivous in front of the level of the eyes, and when retracted bent back ventrally so that the mandibles reach the anterior lobe of the metasternum, with a ridge on either side running obliquely forwards and inwards, from about the middle of the inner margin of the eye almost to the base of the labrum; deeply excavated beneath behind the mentum to receive the antennæ, the posterior ventral edge forming a thin transverse lamina produced into a point

* This name, from *νησος*, an island, and *Theca*, the name of the genus which *Nesotheca* superficially resembles, was selected when I had only the Seychellean species before me. I have subsequently described a species from Tenasserim, indicating that the genus is not exclusively insular; but it is at least abundantly represented in the Seychelles by a complex of species having characters in common distinguishing them from the only Indo-Malayan form known to me, and I therefore publish it under the name first chosen.

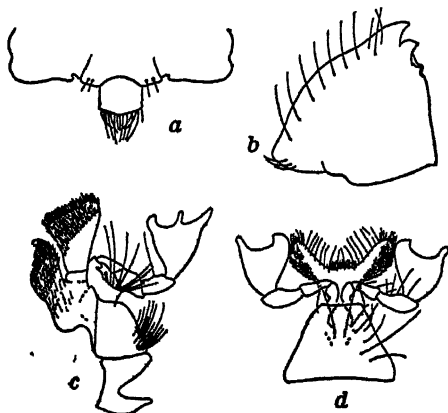
in the middle. *Eyes* of normal form and size, not very prominent, not emarginate. *Antennæ* arising just in front of, and about level with, the inner margin of the eyes, 10-segmented; in the Seychelles representatives of the genus (where the antennæ have been examined in detail in five out

Fig. 18.

*Nesotheca typica.*

a, antenna, $\times 50$; *b*, left front tibia and tarsus, $\times 50$.

Fig. 19.

*Nesotheca typica.*

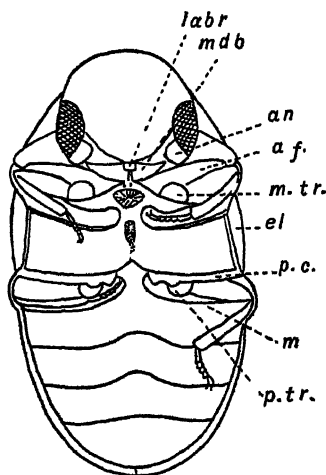
a, labrum and epistome; *b*, mandible (only the setæ visible in profile are shown, not those on the surface); *c*, maxilla; *d*, labium (from the ventral side). All $\times 85$.

of the nine described species *) they are of the form shown in fig. 18 *a*, with segment 3 about $1\frac{1}{2}$ times as long as 4,

* This statement is inserted because the number of antennal segments varies in different species within the limits of certain accepted genera; e. g., 9- or 11-segmented in the species of the North American *Protheca*, Lec., and 8-, 9-, or 10-segmented in those of the North American genus *Eutylstus*, Fall: see H. C. Fall, Tr. Amer. Ent. Soc. xxxi, pp. 259, 264 (1905).

4-7 short and transverse, 5-7 slightly produced distally on the inner side, 8-10 forming a loose club longer than the whole of the rest of the antenna; in the only known Oriental species, *N. tenasserimensis* (p. 416), they are of the form shown in fig. 36 *a, b*, segment 3 being much shorter, only about equal in length to 4, and closely articulated therewith, so that the two at first sight appear almost like one segment, and segments 5-7 also appear more closely articulated. *Labrum* (fig. 19 *a*) minute, nearly as long as wide. *Mandibles* as in fig. 19 *b*. *Maxillæ* (fig. 19 *c*) having the distal parts of

Fig. 20.

*Nesotheca typica.*

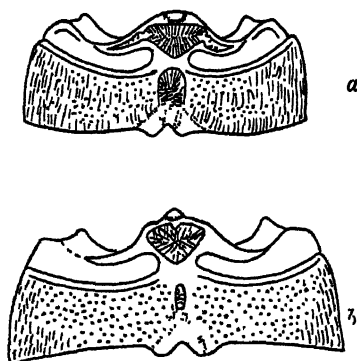
Ventral view, parts retracted, $\times 29$; *a.f.*, femur of anterior leg; *an*, basal segment of antenna; *el*, part of elytron; *labr*, labrum; *m*, hind margin of 1st abdominal segment; *mdb*, mandible; *m.tr.*, trochanter of middle leg; *p.c.*, lamina of posterior coxa, beneath which femur fits; *p.tr.*, posterior trochanter.

galea and lacinia densely covered with short bristly hairs; palpi with terminal segment subtriangular, wide and bi-emarginate at the apex, so that a remarkable "three-fingered" form is produced. *Labium* (fig. 19 *d*) with the outer parts of the lobes densely covered with short bristly hairs; terminal segment of palpi broad and deeply emarginate ("two-fingered") at apex (in *N. tenasserimensis* there is an indication of a third process, fig. 36 *d*). *Prothorax* considerably narrowed in front, its outline usually appearing shallowly sinuate at the sides when viewed from above, the sharp lateral

margins continuing right to the front angles, which are much deflexed, more or less produced forwards, and either considerably less than, or nearly, right angles; hind angles widely rounded off; disc even, the entire surface excessively finely and closely punctulate, and with some larger punctures, the size and closeness of which varies in different species and individuals. *Scutellum* with sides curved, only converging to a definite apex in some species; usually about as long as its breadth at the base; its surface sometimes deflexed at the edges, and frequently raised above the surface of the immediately adjacent part of the elytra, whereby the effect of a broad crack surrounding the scutellum is produced. *Elytra* with subhumeral callus in some species strongly, in others very little, developed; usually with a fine stria very close to the suture, obsolete for a greater or less distance at its front end (this stria is not discernible in *N. tenasserimensis*); with no other striæ, but with regular longitudinal series, and with a short scutellar series, of large punctures; the entire surface of the intervals between the seriate punctures is excessively finely and closely punctulate, and under a high power scattered stronger punctures are discernible among these minute intervallar punctures. *Hind wings* normally developed. *Prosternum* extremely short; *front coxæ* shortly transverse, almost contiguous, separated only by a very narrow intercoxal process. *Mesosternum* with an anterior horizontal portion, and a posterior vertical part applied to the front of the metasternum. When the appendages and head are completely retracted, the pro- and mesosterna are not visible at all; the head meets the anterior lobe of the metasternum, the antennæ are completely packed away under the head, and the front legs are almost hidden between the prothorax and middle legs; the knees of the front and middle legs on each side being received into the space formed by the upward bend of the side-margin of the prothorax near its hind angle, and of the epipleura of the elytron at its base (fig. 20). *Metasternum* short; deeply canaliculate on either side in front to receive the tibiæ and tarsi of the middle legs, with the result that there is formed an anterior lobe of a shape (figs. 20, 21) which may be regarded as a modification of the anvil form found in *Dorcatoma*, the two "wings" of the anvil being curved; the middle part of this anterior lobe is occupied by a large deep pit, broadly triangular in shape with apex directed backwards, and densely filled with pale hairs directed inwards from the sides towards the centre of the space; the front margin of the lobe bears an elevated

tubercle in the middle; the surface of the two curved "wings" is itself usually slightly concave, with raised edges; the part of the metasternum behind the tibial recesses has, in the middle line, another deep pit, varying in different species from very large (fig. 21 *a*) to very small (fig. 21 *b*); this pit also is densely filled with hairs, and from it there extends back a groove or impression reaching to the hind margin of the metasternum. *Meta-episterna* narrow, almost linear, partly hidden under the elytra. *Middle coxæ* widely separated by the anterior metasternal lobe. *Hind coxæ* transverse, forming narrow laminæ under which the femora are in part received. *Epipleuræ* of the elytra deeply emarginate to receive the knees of the hind legs. Visible *ventral*

Fig. 21.



Metasternum of: *a*, *Nesotheca simillima* (♂); *b*, *N. maxima*.
Both $\times 29$.

abdominal segments five; the first is scarcely visible when the hind legs are retracted; when these are pushed aside it is seen on either side as a plate excavated to receive the hind leg, but is concealed in the middle by the intercoxal process projecting forward between the hind coxæ, the visible (ventral) part of which process is formed by the second segment*; hind margins of second and third segments sinuate in the middle. All the *femora* are grooved beneath to receive the tibiz. *Tursi* (fig. 18 *b*) 5-segmented, laterally

* When the detached abdomen is examined in side-view, the intercoxal process is seen to consist of a forward-projecting portion of the second segment, which is also curved downward and is visible in ventral view, fused with a downward- (ventral-) projecting median part of the first segment,

compressed; first segment about as long as the second and third together; segments 2-4 very short; segment 5 longer; claws simple.

External sexual characters: none have been detected, except that the ventral flattening of the abdomen in *N. maxima* appears slightly more marked in the ♂ than in the ♀. The much less definite flattening of the middle part of the abdominal sternites observed in the two ♂♂ of *N. praslinensis*, and in some ♂♂ of *N. communis*, may also be a sexual character.

ÆDEAGUS: over 50 microscopic preparations of this organ of the ♂ were made for the purpose of separating the species. The ædeagus exhibits remarkable specific differences and remarkable constancy of form within each species. All the figures are drawn from the dorsal aspect (*i. e.*, that which is dorsal as the organ lies when retracted into the body). The organ is somewhat flattened dorso-ventrally, and bilaterally symmetrical, the *lateral lobes* (fig. 23 *a*, *l.l.*) being dorso-lateral in position, and bearing more or less hairs towards the apex; the *median lobe* (fig. 23 *a*, *m.l.*) is either subtruncate distally or produced at its two distal angles into processes which are variously shaped, and sometimes hooked at the apex, in the different species; an *internal sac* is present (see especially fig. 31, in which it is indicated by a finely dotted line throughout its length, and figs. 23 *a*, 33 *c*, in which it is partly everted), its surface bears many very fine hairs (indicated in many of the figures on the part of the sac visible between the "horns" of the median lobe), and it has two stout chitinous spines (fig. 23 *a* & *b*, *sp.*; two abnormal specimens are figured, figs. 32 *b*, 33 *b*, in which these spines are asymmetrical, the left-hand one being in one case forked at the apex, in the other case doubled in its entirety). The *basal piece* appears to be composed of two separate chitinous parts: (i.) a distal chitinous portion (fig. 23 *a*, *b.p.*¹), to which the lateral lobes are articulated, and which forms a complete or nearly complete ring; dorsally this part is short, with a median distal cleft, and produced proximally in the middle into a process or spine of varying form; ventrally it is longer, and divided down the middle by a deep cleft, which does not, however (so far as I can determine), extend right to the proximal edge (this division is not usually shown in the figures, but is partly indicated by dotted lines in figs. 25, 26, 32, 33); (ii.) a proximal chitinous piece (fig. 23 *a*, *b.p.*²), forming a thickened rim on the ventral surface, and curving up at each side on to the dorsal surface, but widely interrupted in the mid-dorsal

region; the remainder of the basal piece is membranous. The structure of the base of the median lobe is complex, and there is a *condyle* by which the median lobe is firmly articulated to the basal piece; attempts to separate them have not succeeded.

Some examples of the *ædeagus* in a very reduced and malformed state have come to light, associated with the presence of *NEMATODE* worms; it is hoped to make these the subject of a short separate paper. Many microscopic preparations have also been made of the modified abdominal segments which surround the *ædeagus*, and which are telescoped into the abdomen and not normally visible from the exterior; the structure of these also is interesting, but cannot be entered into here.

Affinities.—As Mons. Lesne has written of the genus *Chondrotheca**, *Nesotheca* must be placed among those genera which possess in the highest degree the faculty of retracting their parts, so as to form perfect little pilules. It is further remarkable for the form of its palpi and the presence of the two deep hair-filled pits on the metasternum. Some species at least of *Theca*—e. g., the European *Th. byrrhoides*, Muls.—have a deep pit and groove corresponding to those on the posterior part of the metasternum in *Nesotheca*, but the latter genus is specially remarkable for the very large and constant pit on the anterior lobe of the metasternum. *Nesotheca* also resembles *Theca* to some extent in general shape and pubescence, but differs in having the antennæ 10- instead of 11-segmented, the elytra only seriate-punctate, but devoid of striæ, and in the strange form of the palpi; it also differs widely in the form of the sterna, since in *Theca* the mesosternum forms a vertical longitudinal lamina between the coxæ and the metasternum has no anterior lobe, while in *Nesotheca* the mesosternum is not visible at all when the parts are retracted, and the metasternum possesses an anvil-shaped front lobe. *Nesotheca* approaches *Dorcatoma* in these characters of the sterna; but *Dorcatoma* has no seriate punctures on the elytra, its eyes are slightly emarginate, and its head is not deeply excavate beneath. In the excavation of the head and the form of the sterna *Nesotheca* seems

* Bull. Mus. Paris, xvi. 1910, p. 307. *Chondrotheca* was described from (and is apparently still known only from) dead examples, which were discovered in burrows in the desiccated edible tubers of an Aroid, found in certain ancient burial-places of the Inca civilisation near Lima, Peru. It is quite possible that the presence of the insects was contemporaneous with the burial of the tubers—i. e., that it dated from the period covering the 12th to 14th centuries of the Christian era.

closely to resemble the South American genus *Chondrotheca*, Lesne (1910), mentioned above; but this has 11-segmented antennæ, no humeral callus, no elytral series of punctures, and no metasternal pits (though the form of its metasternum, especially of the anterior lobe, seems, from Mons. Lesne's figure, to be otherwise closely similar). The Chilian genus *Ascutotheca*, Lesne (1911), also has the head deeply excavated beneath and an auvil-shaped anterior metasternal lobe; but it has 11-segmented antennæ, the scutellum extremely reduced, no humeral callus, no complete series of punctures extending to the base of the elytra, no metasternal pits, and the mesosternum forming a transverse lamina visible when the parts are retracted. The North American *Protheca*, Lec., appears from the descriptions of Leconte (1865) and Fall (1905) to resemble *Nesotheca* in several points; it has the head deeply excavated beneath, the elytra punctate-striate, the mesosternum similarly constructed, and the metasternum forming a transverse anterior lobe, which is described by Fall as "impressed," while Leconte calls the metasternum "deeply foveate between the middle coxæ"; but *Protheca* has the antennæ 11- or 9-segmented, the palpi broadly truncate, not emarginate, at the apex, and the pubescence semi-erect. Another North American genus, *Stichtoptychus*, Fall (1905), which also I have not seen, is structurally very close to *Protheca*, but much larger and of different facies; its antennæ are 11-segmented. Nor have I been able to see *Capnodes*, Broun (1881, New Zealand); this has 11-segmented antennæ, nothing is said about its sterna, and it may be far removed from *Nesotheca*, but it is noteworthy that Broun describes the terminal segments of both pairs of palpi as "large, triangular, [with] the dilated apex tri-sinuate." The North African genus *Rhamna*, Peyerimhoff (1912), has 10-segmented antennæ, but differs widely in the structure of the sterna and in other respects.

Excepting the single specimen from Tenasserim described below as *N. tenasserimensis*, I have found no specimens, named or unnamed, which could be referred to the same genus as *Nesotheca*, in the British Museum. So far as I can judge without seeing examples of all the genera mentioned above, its closest allies would be *Chondrotheca* and *Protheca*, both American. For geographical reasons special attention should be given to *Anakania*, Pic (1901), from Mauritius; its elytra are described as strongly punctured in lines, but the number of antennal segments is not exactly stated, nothing is said about the structure of the sterna, and the insect is variegated in colour.

Differentiation of Species.—This has proved infinitely more difficult in the genus *Nesotheca* than in any other of the Seychelles COLEOPTERA which I have yet studied*. Very little progress was made until recourse was had to examination of the ædeagus. This organ exhibits within the genus at least nine clearly differentiated forms, each remarkably constant within itself, while the external characters of the species are in many cases extremely slight, variable and unsatisfactory, or even for practical purposes inadequate to distinguish the species at all. Nor is the problem completely unravelled; a glance at the remarks under the various species will show that many females and undissected specimens could only be doubtfully or provisionally placed. In very many of these cases it was impossible to be quite sure of their specific position without dissecting every male specimen; and even this would have left many females uncertainly placed, since, owing to the necessity of bringing this faunistic study to its conclusion, it has not been possible to undertake an examination of the female genital organs, which might also provide good differentiating characters. It is doubtful whether any additional species are present among the undissected material; after more than 50 preparations had been made, dissection was stopped, as the same forms of ædeagus kept recurring, and also many of the specimens dissected were proving to be females.

The whole material of the genus numbered about 505 specimens. It was tolerably easy to separate off, by examination of external characters, the long series of *N. typica* and the specimens of *N. maxima*. Between these two extremes the material formed a most difficult complex, with apparently every intergradation of size and other external features. Days were spent in an attempt at grouping the specimens by careful examination of them, individually, under the microscope, but this grouping was subsequently upset in many cases by study of the ædeagus. The most difficult part of the complex was formed by *N. communis* and *N. simillima*, which are, externally, practically inseparable, and *N. praslinensis*, the external characters of which might intergrade into those of small specimens of *N. communis*.

The species most abundant in the material is *N. typica* (275 examples), and after it *N. communis* (22 examples certain, and probably the greater part of a series of 112

* So far as I have had experience, the difficulty can only be likened to that of discriminating the species among certain of the more obscure small Hawaiian beetles, *e. g.* NITIDULIDÆ.

specimens provisionally placed): the other species are represented by much shorter series.

Distribution and Habitat.—The nine described Seychelles species—possibly together with others not yet discovered—compose what is probably an endemic complex. It is interesting that the genus is also represented in the Orient by *N. tenasserimensis*, known at present only from a single specimen, which exhibits in the form of its antennæ and labial palpi slight differences from the Seychelles species, such as may possibly in future necessitate the constitution of distinct subgenera. There are reasons also for thinking that the genus may have representatives, as yet undescribed (1914), in Mauritius.

The large material from the Seychelles was obtained exclusively in the endemic forests—the damp jungles at high elevations in Mahé and Silhouette, or the forest of Coco-de-mer Palms (*Lodoicea*) in the Vallée de Mai, Côtés d'Or Estate, Praslin. Unfortunately my journal and field-notes contain no exact record of how they were found, but I have little doubt that large numbers were taken, probably in company with *CIDÆ* and *IPIDÆ* (*SCOLYTIDÆ*), from hard kinds of fungi; in my manuscript list of data many of the *Nesothecæ* occur under numbers associated with the record "Scolytids from fungus," and probably "Scolytids" refers in large part to the *Nesothecæ*, which I may have failed to distinguish from *SCOLYTIDÆ* in the field.

Though the external characters alone are often so unsatisfactory a criterion, the following attempt to form a key has been made (no account is taken here of the form of the aedeagus):—

A. Antennæ with segment 3 about $1\frac{1}{2}$ times as long as segment 4.

a. Prothorax with base reflexed, forming a fine basal line. Seriate punctures on elytra circular, not elongate-oval.

α. Form relatively long and narrow.

i. Larger; pubescence whitish; head impressed; surface smooth and even; seriate punctures small; intervallar punctulation with only a few scattered, slightly stronger points (often not discernible). (Length 2·3–1·7 mm.)

N. typica, p. 396.

ii. Smaller; pubescence slightly yellowish; head not impressed; seriate punctures relatively larger; general surface of elytra less even; distinctly larger punctures scattered among the intervallar punctulation. (Length 1·7 mm.)

N. cognata, p. 103.

- β. Form broadly oblong; dorsum rather depressed; subhumeral calli very prominent.
- i. Smaller; surface of elytra more or less rugulose; distinctly larger punctures scattered among the intervallar punctulation. (Length 1.8-1.9 mm.) *N. lateoblonga*, p. 399.
 - ii. Larger; surface of elytra rather dull, but not rugulose; only slightly stronger points scattered among the intervallar punctulation. (Length 2.0 mm.) *N. subdepressa*, p. 401.
- δ. Prothorax with base not reflexed, no basal line (a very faint trace in *N. germana*). Seriate punctures on elytra always more or less elongate-oval.
- a. Posterior pit on metasternum large (cf. fig. 21 a).
 - i. Broadly oblong; subhumeral calli prominent; surface relatively dull, that of the elytra uneven, almost rugulose; distinctly larger punctures scattered among the intervallar punctulation (faint trace of basal thoracic line sometimes present). (Length 1.6-1.9 mm.) *N. germana*, p. 407.
 - ii. Subhumeral calli less prominent; surface smooth and shining; only slightly stronger points scattered among the intervallar punctulation.
 1. Smaller; seriate punctures only slightly elongate. (Length 1.9 mm.) *N. prasinensis*, [p. 405.
 2. Larger; seriate punctures markedly elongate. (Length 1.6-2.3 mm.) *N. communis* and *N. similima*, pp. 401 [412.
 - β. Posterior pit on metasternum very small (cf. fig. 21 b). Large, ovoid, convex; subhumeral calli much reduced. (Length 2.4-2.6 mm.) *N. maxima*, p. 414.
- B. Antennæ with segment 3 only about equal in length to segment 4. (Length 1.7 mm.) *N. tenasserimensis*, [p. 416.

Type of the genus : *Nesotheca typica*, sp. n.

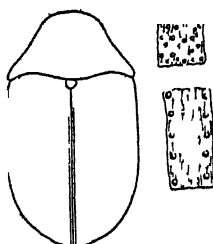
14. *Nesotheca typica*, sp. n.

Sat elongata et angusta, elytrorum lateribus fere parallelis, prothorace sat brevi; modice nitens, picea, ex parte rufescens, pubescentiâ albidâ; capite inter oculos leviter impresso; prothorace basi tenuiter lineatâ; scutello lateribus sat late arcuatis; elytris callo subhumerali modico prominulo, striâ suturali fere ad scutellum attingente, punctis seriatis circularibus, sat parvis, illis intervallorum subtilissimis, aliquibus vix fortioribus, superficie lævi; metasterno omnino fortiter punctato ac pubescente, foveâ posteriore sat parvâ, sulco profundo, angusto, ad marginem posteriorem attingente.

Long. corp. 2.3-1.7 mm.

Relatively long and narrow, with elytra nearly parallel-sided; prothorax rather short in proportion to elytra, the latter (seen from above) being about $2\frac{1}{2}$ times as long as the former. Colour less deep blackish, with a more reddish tinge, especially on the underside and sloping sides of the elytra. Pubescence whitish. Surface moderately shining. *Head* slightly impressed between the eyes in both sexes, finely and closely punctate, with punctures of two sizes, as on the prothorax. *Prothorax* with a very fine line along the base*; the larger punctures scattered rather unevenly, from one to several times their own diameter apart, all the intervals filled with extremely fine, minute punctulation. *Scutellum* with sides rather broadly rounded. *Elytra* with subhumeral callus moderately prominent; sutural stria extending from

Fig. 22.

*Nesothecha typica.*

Outline, $\times$ ca. 14, and fragments of surface of prothorax and elytra, $\times$ 50.

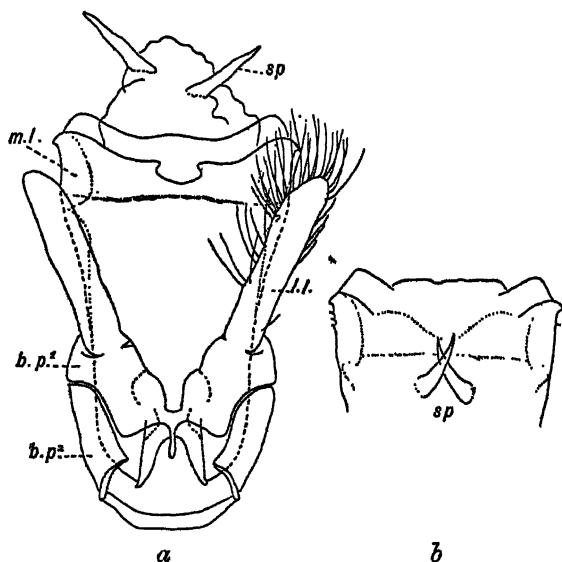
the apex nearly to the scutellum, only vanishing at about $\frac{1}{2}$ the length of the elytron from the base; seriate punctures relatively small, circular, and those of each series usually two or more times their own diameter apart; intervals between the series closely covered with fine minute punctures, some of which appear as slightly stronger points, though this is not easily discernible in all aspects. All the interstices between the punctuation on prothorax and elytra are smooth and shining, without trace of rugulosity or striolation. *Metasternum* strongly and closely punctured, and pubescent all over, even in the middle of the posterior part; the posterior pit is rather small and narrow, pushed rather far forward, right to the base of the anterior lobe, and a deep narrow groove extends back from it to the hind

* This line is not shown in figure 22.

margin of the metasternum. *Abdominal segments* strongly and rather closely punctured and pubescent.

Ædeagus (four examples examined) with lateral lobes rather short and broad and nearly parallel-sided; basal piece dorsally with a broad cleft, truncate at the bottom, and produced proximally into a long, narrowly spatulate, process; median lobe broad, widening slightly towards its distal extremity, which is subtruncate; the distal angles are not produced, but obliquely truncate, each forming a small

Fig. 23.

*Nesotheca typica.*

a, aedeagus (hairs omitted on one side, lettering explained in text, p. 391) with sac partly everted; *b*, apex of median lobe of another example with sac retracted. Both $\times$ ca. 113.

blunt hook proximally; the marginal part of the distal extremity of the median lobe is translucent and colourless, sharply separated from a deeply pigmented, strongly chitinated, transverse band, which again is clearly demarcated proximally from the less deeply pigmented main part of the median lobe (this latter line of demarcation is indicated in fig. 23 by a finely dotted, nearly straight, transverse line); spines on the internal sac relatively short and broad at the base, tapering to a sharp point.

Loc. Seychelles. Silhouette, Mahé. Silhouette: forest near Mont Pot-à-eau, about 1500 feet, viii. 1908; forest above Mare aux Cochons, about 1000–2000 feet, ix. 1908, several long series (some or all of which were almost certainly taken from fungi). Mahé: near Morne Blanc, about 1000 feet, and high forests of Morne Blanc and Morne Pilot, up to over 2000 feet, x.–xi. 1908; high damp forest between Trois Frères and Morne Seychellois, about 1500–2000 feet, xii. 1908 and i. 1909; Mare aux Cochons district, about 1000–2000 feet, 26. i.–2. ii. 1909; forests above Cascade, about 1000–2000 feet, i.–iii. 1909. A very long series of about 275 examples, from all parts visited of the endemic forests of Mahé and Silhouette, up to the highest and dampest areas.

This species is relatively easy to distinguish by its long narrow form, the impressed head, the shortness and whitish colour of the pubescence, the smallness and circular shape of the seriate punctures, and the general smoothness and evenness of the whole surface. By these characters it was possible to separate a series of some 275 examples from the remaining material of the genus, before recourse was had to dissection of the genital armature, and it only seemed necessary to dissect few examples of this species. Nevertheless, there is considerable variability, especially in size, and a certain percentage of the specimens are broader in proportion to their length than the normal. Some 20 of these abnormally broad examples were at first referred only doubtfully to this species, but when 3 ♂♂ from among them were dissected, the aedeagus was found in every case to agree closely with that of an individual of normal breadth.

15. *Nesotheca lateoblunga*, sp. n.

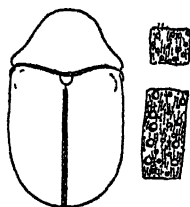
Sat curta et lata, elytrorum lateribus fere parallelis, elytrorum dorso parum deplanato, callis subhumeralibus valde prominulis; obscure rufo-picea, parum opaca, pubescentia flavescendo; capite densius ac fortius punctato; prothorace punctis majoribus densis, basi tenuiter lineatâ; scutello lateribus sat late arcuatis; elytris striâ suturali fere ad scutellum attingente, punctis seriatis sat magnis, circularibus, illis intervallorum densissimis, ex majoro parte subtilissimis, sed aliquibus majoribus inter puncta minuta sparsis, superficie parum transversim rugulosâ.

Long. corp. 1.8–1.9 mm.

Rather short and broad, sides of elytra nearly parallel; viewed from above the elytra appear rather flattened on the disc, with subhumeral calli very prominent; surface rather dull (one or two specimens more shining than the rest),

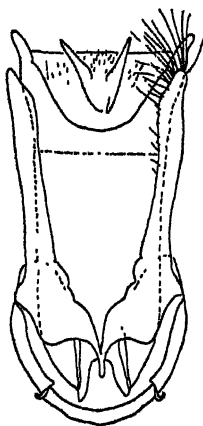
colour dark reddish-pitchy, pubescence with a yellowish tinge. *Head* very strongly, closely, and subrugulosely punctured, the large punctures (in the type, at least) almost touching, and leaving scarcely any room for the minute interstitial punctures. *Prothorax* strongly and closely punctured, the large punctures frequently only about their

Fig. 24.

*Nesothea lateoblonga.*

Outline, $\times$ ca. 14, and fragments of surface of prothorax and elytra, $\times$ 50.

Fig. 25.

*Nesothea lateoblonga.*

Ædeagus (hairs omitted on one side), $\times$ ca. 113.

own diameter (or even less) apart, the interstices filled with minute fine punctures; base with a fine marginal line. *Scutellum* with sides arcuate. *Elytra* with sutural stria traceable almost as far forward as the scutellum; seriate punctures rather large, circular or almost so, those of each series usually only separated by a distance about equal to

their own diameter, sometimes even less; the intervals are extremely densely covered with very fine punctures, among which some larger ones (intermediate in size between the minute punctures and the big seriate punctures) are scattered; the surface of the intervals is uneven, slightly wrinkled transversely, producing a rugulose appearance, especially marked in some specimens. *Metasternum* with its posterior part deeply grooved, and the posterior pit right at the front end, against the base of the anterior lobe.

Ædeagus (six examples examined) with lateral lobes rather slender, bluntly rounded at apex, obliquely truncate and very slightly sinuate on the inner side just below the apex; basal piece dorsally with a deep cleft tapering to a point, produced proximally into a narrow, rather long process; median lobe nearly parallel-sided throughout the greater part of its length, widening a little distally, with the distal angles produced into rather long horns, which are bluntly rounded at the apex, not hooked; spines on internal sac rather short, each with its base very oblique, so that its outer side is much longer than the inner.

Loc. Seychelles. Silhouette, Mahé, Praslin. Silhouette: forest above Mare aux Cochons, over 1000 feet, viii.-ix. 1908. Mahé: near Morne Blanc and high forests of Morne Blanc and Morne Pilot, 1000 to 2000 feet (or above), xi. 1908; forest above Cascade, nearly 2000 feet, 2. iii. 1909. Praslin: Côtes d'Or Estate, from forest of Coco-de-mer Palm (*Lo-doicea*), xi. 1908.

The above description is based on the ♂ selected as type and five other ♂♂, from all of which the genital armature was dissected. Four of these ♂♂ had been placed together, previous to dissection of the armatures, on account of their similarity in external characters, especially the broadly-oblong form, the prominent calli, the flattened dorsum, and the rugulosity of the elytra. In the two remaining ♂♂ these characters are less definite, especially the rugulosity, and it was quite uncertain where they should be placed, until the *ædeagus* was examined. I have little hesitation also in referring two specimens, which dissection proved to be ♀♀, to this species.

16. *Nesotheca subdepressa*, sp. n.

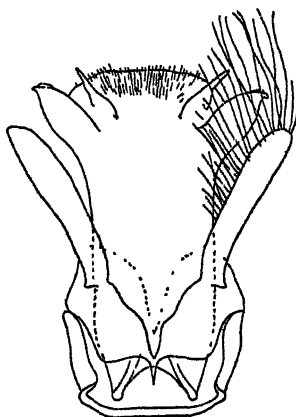
Major, lata, suboblonga, elytrorum dorso sat deplanato, callis subhumeralibus eis *N. lateoblongæ* perparum minus prominulis; obscure rufo-picea, opaca, pubescentia plus minusve flavescens; prothorace fortiter ac dense punctato, basi tenuiter lineata; scutello lateribus arcuatis; elytris stria suturali antice vix

desinente, punctis seriatis circularibus, illis intervallorum densissimis, subtilissimis, sed aliquibus parum fortioribus inter ea sparsis, superficie haud rugulosâ.

Long. corp. 2.0 mm.

Larger than *N. lateoblonga*, very broad, suboblong, with dorsal surface of elytra flattened, subhumeral calli a trifle less prominent than in *N. lateoblonga*; surface dull, colour very dark pitchy-reddish, pubescence more or less markedly yellowish. *Prothorax* with a fine basal line, larger punctures strong and very close, separated by only about their own diameter, or frequently almost contiguous. *Scutellum* with sides arcuate. *Elytra* with sutural stria traceable forwards almost to the scutellum, only becoming obsolete in front

Fig. 26.



Nesothea subdepressa.

Ædæagus (hairs omitted on one side), $\times$ ca. 113.

in a very small fraction of its length; seriate punctures circular, of moderate size, those of a series separated usually by a distance equal to between once and twice their own diameter; the minute intervallar punctures are extremely crowded, producing in some aspects almost a reticulate appearance, while scattered among them is a number of slightly stronger points; the general surface is dull, but not rugulose. *Metasternum* with the posterior pit right at the front end of its posterior part, and a fairly deep groove extending back from it to the hind margin.

Ædeagus (two examples examined) with lateral lobes nearly parallel-sided, obliquely rounded off at the extremity,

so that the outer side continues straight for a longer distance than the inner; basal piece dorsally with a deep cleft tapering to a point, and produced proximally into a rather long, pointed spine; median lobe parallel-sided throughout the greater part of its length, produced distally into two widely-diverging, broad, stout "ears" or horns, each with a small hook at its outer extremity, and an angulate transparent ridge just on the inner side of this hook; spines on the internal sac short, narrowing rather suddenly from a broad oblique base to a somewhat slender apical portion. In the form of the distal extremity of the median lobe this aedeagus recalls that of *N. praslinensis*, though it is very different in other respects.

Loc. Seychelles. Mahé: high damp forest at summit of Morne Pilot, over 2000 feet, x. or xi. 1908; high damp forest between Trois Frères and Morne Seychellois, about 1500-2000 feet, xii. 1908.

The two ♂♂ on which description of this species is based are characterised by their broadly oblong, rather depressed form and prominent subhumeral calli, by having the base of the prothorax finely reflexed, so as to produce a distinct basal line, and by the generally dull, but not rugulose, surface. No other specimens are referred to this species, but see remarks under *N. germana*.

17. *Nesotheca cognata*, sp. n.

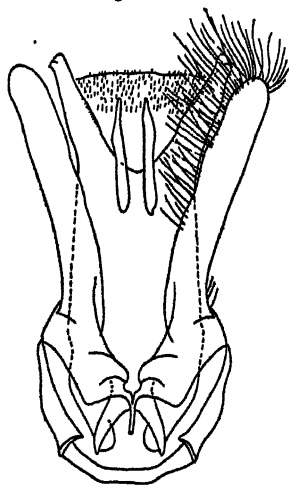
N. lateoblunga similis, sed minor ac angustior; prothorace elytrisque similiter punctatis, horum superficie vix rugulosa. A *N. lateoblunga* in formâ aedeagi valde differt, ut infra descriptum est. Long. corp. 1.7 mm.

Very similar to *N. lateoblunga*, but smaller and narrower; sides of elytra nearly parallel, subhumeral calli prominent. *Prothorax* similarly punctured, and with a fine basal line. *Scutellum* with sides arcuate. *Elytra* with sutural stria discernible nearly to the scutellum (in one specimen hardly traceable at all); seriate punctures circular, of about the same size and degree of closeness as those of *N. lateoblunga*; punctuation of the intervals similar, with larger punctures scattered among the very fine punctuation; rugulosity of the surface very little apparent, but discernible in the scutellar region under a microscope. *Metasternum* and *abdominal segments* strongly punctured and pubescent all over; posterior pit right at the front end of the posterior part of the metasternum, against the base of the anterior

lobe, large, with a deep groove extending from it to the hind margin of the metasternum.

Ædeagus (four examples examined) with lateral lobes rather broad, nearly parallel-sided, inner side very slightly sinuous, apex rather widely arcuate; basal piece dorsally with a rather wide cleft, broadened at the bottom into a space with curved sides, which is produced into a very narrow fissure, and with a very long, narrow, proximal spine; median lobe proportionately narrower than in *N. lateoblonga*, narrowing slightly towards the distal extremity, then produced at either side into a rather stout, diverging horn, the extremity of which is obliquely truncate,

Fig. 27.



Nesothea cognata.

Ædeagus (hairs omitted on one side), $\times$ ca. 113.

and bluntly rounded on the inner, but sharply angulate on the outer, side; the extremity of each horn is formed by a thin colourless lamina on the inner side, this being sharply demarcated from the pigmented outer portion, the line of separation being indicated in fig. 27 by a finely dotted line; spines on the internal sac long and narrow, with a swelling on the outer side in the distal half; probably all the outer side proximal to this swelling is really the base of the spine, which (if this be so) has a very long, nearly vertical, base, a very short outer and a very long inner side.

Loc. Seychelles. Silhouette, Praslin. Silhouette: forest

near to Mare aux Cochons, and above, over 1000 feet, viii.-ix. 1908. Praslin: forest of Coco-de-mer Palms (*Lo-doicea*) in the Vallée de Mai, Côtés d'Or Estate, xi. 1908. Of the four dissected ♂♂, two are from Silhouette, two from Praslin; of the thirteen specimens provisionally referred to this species, one is from Silhouette and twelve from Praslin.

Not only does this species resemble *N. lateoblunga* as stated above, but also by its relatively long and narrow form it might be taken for a very small edition of *N. typica*; it differs, however, not only in its smallness, but in having the prothorax proportionately longer, the head not impressed, the pubescence a little more yellowish, and the general surface of the elytra slightly less even, some distinctly larger punctures being scattered among the minute intervallar punctulation; this last character is not very satisfactory, being difficult to discern, especially when the elytra are not denuded of pubescence. The description is drawn up from the type and three other ♂ examples in which the aedeagus has been examined; 13 other specimens (three proved by dissection to be ♀♀, the remainder not dissected) are also provisionally assigned to this species, to which the majority of them almost certainly belong, while in a few cases there is some uncertainty.

18. *Nesotheca praslinensis*, sp. n.

Minuta, curta ac lata, nitida, elytrorum dorso convexo, callis subhumeralibus modice prominulis; prothorace basi haud lineatâ; scutello sat angusto, lateribus arcuatis, apice subacuto; elytris striâ suturali fere ad scutellum attingente, punctis seriatis magnis, parum elongatis, illis intervallorum minutis, subtilissimis, sed aliquibus perparum fortioribus, superficie haud rugulosâ; metasterno foveâ posteriore magnâ, sulco lato; formâ aedeagi, præcipue loborum lateralium, omnino distincta.

Long. corp. 1.9 mm.

Very small, short and broad, dorsal surface more convex than in either of the two preceding species, but subhumeral calli fairly well-marked; sides of prothorax (viewed from above) scarcely sinuate, very little expanded towards base; colour pitchy, surface shining, pubescence yellowish-tinged. *Prothorax* without any fine basal line visible when the parts of the body are normally connected together; surface with larger punctures from about once to several times their own diameter apart, all the interstices covered with very fine, minute punctures. *Scutellum* rather narrow, sides arcuate,

but an apex is more discernible than in some species. *Elytra* with sutural stria traceable from the apex nearly to the scutellum; seriate punctures large, slightly elongate, rather close, those of a series separated by a distance about equal to their own length or rather greater; intervals closely and extremely finely punctured, some of the punctures (irregularly scattered) being slightly stronger than the rest, but

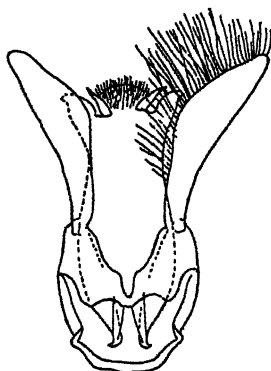
Fig. 28.



Nesotheca pruslinensis.

Outline, $\times$ ca. 14.

Fig. 29.



Nesotheca pruslinensis.

Aedeagus (sac partly exerted, hairs omitted on one side),
 $\times$ ca. 113.

these only appear under a high power as rather stronger points (not as tiny circles intermediate in size between the minute points and the big seriate punctures, as in the two preceding species); surface not rugulose. *Metasternum* with posterior pit large, and groove broad. *Ventral abdominal segments* slightly flattened in the middle.

Aedeagus (two examples examined) with lateral lobes markedly broadened, forming a very wide angle, just beyond the middle of the inner side; basal piece dorsally with a short, rather wide cleft, rounded at the bottom, not produced, but truncate in the middle proximally; median lobe flask- or vase-shaped, narrowing beyond the middle, then widening into two short broad horns with curved sides, and slightly hooked at the extremity; spines on internal sac short, suddenly narrowed a little distal to the middle of their length, with outer side nearly as long as inner.

Loc. Seychelles. Praslin: forest of Coco-de-mer Palms (*Lodoicea*), Vallée de Mai, Côtés d'Or Estate, xi. 1908, 2 ♂♂.

In having no basal line on the prothorax, a more convex dorsum, the seriate punctures elongate, the general surface even, and the scattered larger punctures on the intervals only appearing as slightly stronger points than the general intervallar punctulation, this species resembles *N. communis* and *N. simillima*; the seriate punctures are, however, only slightly elongate, much less so than in most examples of the group of species in which this character occurs. The external characters of *N. praslinensis* are unsatisfactory, and only the two ♂♂ of which the aedeagus has been examined are referred to it, but probably other examples are present among the smaller specimens of the long series which I have been compelled to leave provisionally under *N. communis*.

19. *Nesotheca germana*, sp. n.

Curta et lata, suboblonga, sat opaca, callis subhumeralibus sat fortiter prominulis; prothorace lateribus (desuper visis) ad basin expansis, in medio sat conspicue sinuatis, lineâ basali nullâ; elytris striâ suturali fere ad scutellum attingente, punctis seriatis magnis, parum elongatis, illis intervallorum minutis, subtilissimis, sed aliquibus inter ea distincto majoribus; metasterno foveâ posteriore magno, sulco profundo postice latiore.

Long. corp. 1.6-1.9 mm.

Short and broad, elytra parallel-sided, a distinctly oblong appearance being thus produced; subhumeral calli strongly developed; sides of prothorax considerably expanded towards the base, so that the sinuation of its sides (when viewed from above in examples with the parts retracted) is much more marked than in the preceding species. Colour pitchy-blackish, surface relatively dull, pubescence with a faint yellowish tinge. *Prothorax* with base sometimes very slightly elevated, producing a faint indication of a basal line in some

examples ; surface with the larger punctures usually about twice their own diameter apart, interstices closely and extremely finely punctured. *Scutellum* with sides arcuate. *Elytra* with sutural stria extending forwards almost to the scutellum ; seriate punctures large, often a little elongate, those in a series usually about twice their own length apart, or less ; intervals very closely covered with extremely fine

Fig. 30.

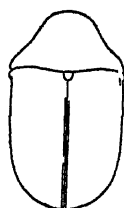
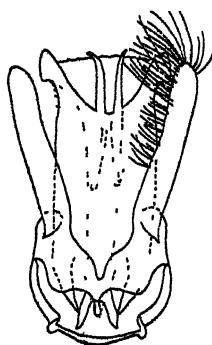
*Nesotheca germana.*Outline, $\times$ ca. 14.

Fig. 31.

*Nesotheca germana.*

Aedeagus, $\times$ ca. 118 (hairs omitted on one side ; one spine is lying in a plane at right angles to the other).

points, among which are scattered some larger punctures, big enough to appear as tiny circles under a high power ; there is some transverse wrinkling and unevenness of the surface, scarcely amounting to rugulosity. *Metasternum* closely and strongly punctured all over its posterior part ; posterior pit large, placed forward right at the base of the

anterior lobe, the groove extending from it to the hind margin deep and widening behind. *Ventral abdominal segments* not flattened in the middle.

Ædeagus (four examples examined) with lateral lobes nearly parallel-sided, with bluntly arcuate apex; basal piece with a short dorsal cleft tapering to a blunt point at the bottom, and produced proximally into a spine of moderate length, which is slightly widened towards its extremity; median lobe nearly of the same width throughout, produced into two short broad horns slightly hooked on their proximal side; spines on the internal sac very long and slender, curved outwards at the apex. In the preparation from which fig. 31 was drawn, the internal sac is so clearly traceable throughout the length of the median lobe, and continuing out through the base of the ædeagus as a narrow membranous tube, that I have indicated it by a finely dotted line.

Loc. Seychelles. Silhouette, Mahé. Silhouette: forest near Mont Pot-à-eau, about 1500 feet, viii. 1908; forest near Mare aux Cochons and above, over 1000 feet, viii.-ix. 1908. Mahé: Cascade Estate, forest above 1000 feet, i. 1909. The four dissected ♂♂ were found, three in Silhouette, one in Mahé; the six examples provisionally referred to the species are all from Silhouette.

In having the seriate punctures elongate, this species resembles the group of forms including *N. communis* and *N. simillima*; but in its oblong form, the prominence of the calli, relatively dull surface, and the presence among the minute intervallar punctulation of scattered larger punctures (big enough to appear under a high power as tiny circles, not merely as stronger points) it approaches somewhat to *N. subdepressa*. As regards presence or absence of a basal prothoracic line, it is intermediate between the group formed by the first four species of the genus and the later species, for, while there is no definite line as in the former, the hind margin is very slightly elevated in some specimens, so that all trace of a basal line is not so completely absent as in the latter group. I definitely assign to this species the four ♂♂ in which the ædeagus has been examined, and provisionally refer to it five ♀♀ (sex proved by dissection) and one specimen of undetermined sex; the position of some of these last is rather doubtful, a few of them approaching *N. subdepressa* in some respects.

20. *Nesotheca communis*, sp. n.

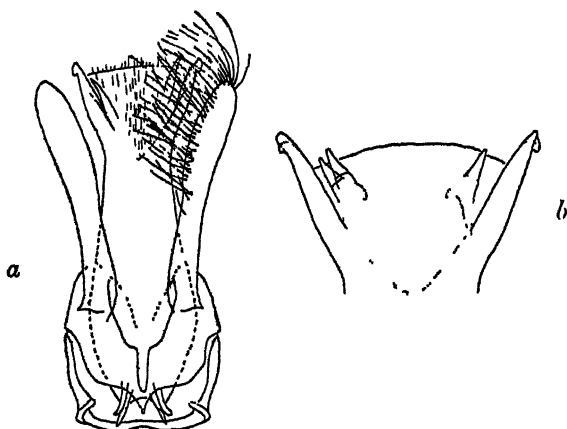
Staturâ varians, plerumque sat magna, lævis, nitida, suboblonga,
Ann. & Mag. N. Hist. Ser. 9. Vol. xiv. 27

elytorum dorso magis convexo, callis subhumeralibus minus prominulis; prothorace lateribus (desuper visis) haud fortiter sinuatis, lineâ basali nullâ, punctis majoribus minus confertis; elytris striâ suturali in parte anteriore fere quartâ obsoletâ, punctis seriatis magnis, crebre valde elongatis, illis intervallorum minutis, subtilissimis, sed aliquibus inter ea perparum fortioribus; metasterno foveâ posteriore variabili, vel majore vel minore, plerumque sat angusto, interdum conspicue elongato.

Long. corp. 1·6–2·3 mm.

Varying greatly in size, but usually much larger than either of the two preceding. Suboblong; dorsum rather more convex, expansion of the prothorax towards its base

Fig. 32.



Nesotheca communis.

a, aedeagus (hairs omitted on one side), $\times$ ca. 113; *b*, apex of median lobe of an example with left-hand spine double, $\times$ ca. 233.

and the sinuation of its sides, and subhumeral calli of the elytra, less marked than in *N. germana*. Colour pitchy-black, general surface smooth and shining, pubescence yellowish. *Prothorax* without basal line; punctuation varying somewhat in different specimens, but the larger punctures are (comparing this with other species) relatively small and far apart, separated often by about four times their own diameter. *Scutellum* rather small and narrow, with arcuate sides, but a pointed apex is discernible. *Elytra* with sutural stria usually obsolete in about the anterior quarter of their length; seriate punctures very large, generally

markedly elongate (sometimes about twice as long as wide), those of a series separated only by about their own length or even less; intervals minutely and very finely punctulate, with rather numerous scattered stronger punctures, but these latter only appear under a high power as stronger points (cf. *N. praslinensis*), not as punctures with an appreciable diameter; general surface quite even, no trace of rugulosity. *Metasternum* with posterior pit variable, bigger or smaller, usually rather narrow; in some specimens it is further forward, in others at about the middle of the posterior part, in others again it extends practically the whole length of the posterior part; the rest of this part of the metasternum is strongly and closely punctured. *Ventral abdominal segments* deeply, strongly, and fairly closely punctured, not (or in some specimens very slightly) flattened in the middle.

Ædeagus (twenty-two examples examined) with lateral lobes slightly broadened on the inner side a little distal to the middle, bluntly rounded at the apex; basal piece dorsally with a deep, rather narrow cleft, and produced proximally into a short tapering process which appears knobbed at the extremity; median lobe vase-shaped, rather narrow, narrowing considerably from about $\frac{1}{4}$ to about $\frac{3}{4}$ of its length from the base, then diverging into two long horns, hooked at the extremity, the extreme apex of each horn being colourless, sharply demarcated from the pigmented proximal portion (as indicated by a finely dotted line in fig. 32 *b*); spines on the internal sac short, rather slender, sharp-pointed (in one specimen, fig. 32 *b*, the left-hand spine is completely doubled to its base; compare fig. 33 *b* of an example of *M. simillima*).

Loc. Seychelles: Silhouette, Mahé, Praslin. Silhouette: forest above Mare aux Cochons, about 1000–2000 feet, viii.–ix. 1908. Mahé: near Morne Blanc, x. or xi. 1908; Mare aux Cochons district, 1000–2000 feet, i.–ii. 1909. Praslin: forest of Coco-de-mer Palms (*Lodoicea*), Vallée de Mai, Côtes d'Or Estate, xi. 1908. 13 ♂ examples from Silhouette, 2 from Mahé, and 7 from Praslin.

The series of some 140 examples referred to below, which can only be placed provisionally under *N. communis*, together with 7 other specimens, the specific position of which must be left quite doubtful, are from many localities in the endemic mountain forests of Silhouette and Mahé, and the Coco-de-mer forest in Praslin (Côtes d'Or Estate), but a detailed list would serve no useful purpose.

This species is one of those in which there is absolutely no

trace of elevation or reflexion of the hind margin of the prothorax (and consequently no trace of a basal line). It is further characterised by its generally pitchy-black colour, the smooth, even, shining surface, the yellowish colour of the pubescence, the elongate form of the seriate punctures, and by the larger punctures scattered among the minute intervallar punctulation appearing only as slightly stronger points. From *N. maxima* it is distinguished by its smaller size, more oblong, parallel-sided form, more prominent calli, the relatively closer and stronger punctuation of the prothorax, and the much larger posterior metasternal pit. In the last two characters—degree of closeness of the punctuation and size of the posterior pit—it is, however, variable, and it also exhibits a high range of variability in size. In a long series I have not found it possible—without examination of the ædeagus—to separate *N. communis* from *N. simillima*, while the smallest examples may be confused with *N. prasinensis*. The 22 ♂♂ in which the ædeagus has been examined are therefore definitely referred to this species, while a further long series of some 140 specimens is placed provisionally under it; the great majority of these latter probably are actually *N. communis* (out of 32 specimens determined by examination of the ædeagus from among this group of species, 22 proved to be *N. communis*, which indicates that the latter is the most numerous), but some should probably be placed elsewhere.

21. *Nesotheca simillima*, sp. n.

N. communis simillima, sed pubescentiâ conspicue flavâ, callis subhumeralibus minus prominulis, striâ suturali fere ad scutellum attingente; in formâ ædeagi conspicue dissimilis, ut infra descriptum est.

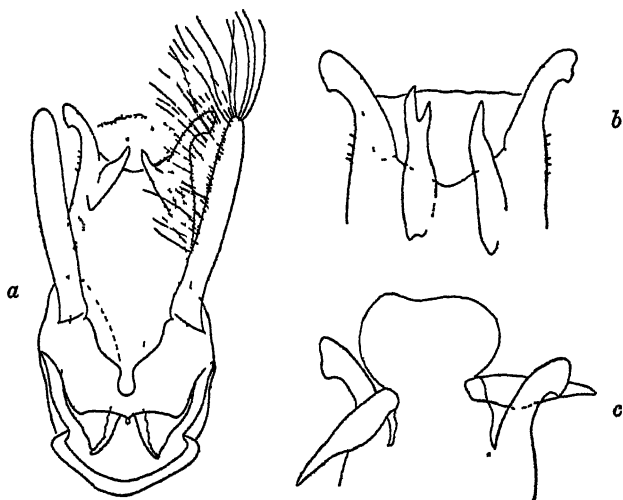
Long. corp. 2.0 mm.

Extremely closely resembling the larger specimens of *N. communis*; the only describable differences in external characters appear to be the much yellower colour of the pubescence, the slightly less marked subhumeral calli, and the fact that the sutural stria extends forwards almost to the scutellum, only becoming obsolete in about the anterior $\frac{1}{2}$ the length of the elytron. *Metasternum* (see fig. 21a) with posterior pit large and relatively wide; punctuation becoming subobsolete in the median part, on either side of this pit.

Ædeagus (five examples examined): though this species so closely resembles *N. communis* in external characters, yet

the ædeagi of the two are very strikingly different; in the present species the lateral lobes are narrow, bluntly rounded at the apex; the basal piece has dorsally a short, rather broad cleft, subtruncate at the bottom, and a very short proximal spine; the median lobe is somewhat dilated near its base, then nearly of the same width throughout, slightly narrowing towards its extremity (certain chitinous thickenings in its lateral walls are indicated in fig. 33 *a* by finely dotted lines), then produced into two curved diverging horns, recalling, more than those of any other species, the

Fig. 33.

*Nesothecha similima.*

a, ædeagus (hairs omitted on one side), $\times$ ca. 113; *b*, apex of median lobe of an example with left-hand spine forked, $\times$ ca. 197; *c*, apex of median lobe with sac and spines everted, $\times$ ca. 197.

handles of some kinds of jars; extreme apex of each horn thin and colourless, sharply demarcated from the pigmented part, as indicated in figs. 33 *a* and *b* by finely dotted lines; spines on the internal sac rather short, very robust (in one specimen, fig. 33 *b*, the left-hand spine is forked at the apex; compare fig. 32 *b*).

Loc. Seychelles: Silhouette, Mahé. Silhouette: Mare aux Cochons, over 1000 feet, ix. 1908, 4 ♂♂. Mahé: Cascade Estate, about 1000 feet, i. 1909, 1 ♂.

The five ♂♂ in which the ædeagus has been examined

are all the specimens which can be definitely referred to this species, but other examples may be present among the long series placed provisionally under *N. communis*; for, although I have described some slight differences from *N. communis* exhibited by the five ♂♂, yet, as explained at length above under *N. communis*, the two species are for practical purposes indistinguishable, by means of external characters alone, in a long and variable series. It is remarkable that the form of the ædeagus in the two should be so clearly distinct.

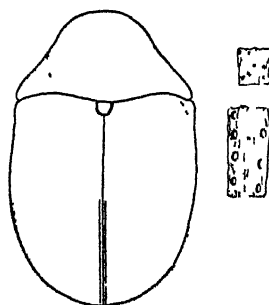
22. *Nesotheca maxima*, sp. n.

Magna, ovoidea, dorso fortiter convexo, callis subhumeralibus vix prominulis; piceo-nigra, lævis, nitida, pubescentiâ griseo-flavâ; prothorace subtiliter parce punctato, lineâ basali nullâ; scutello lateribus arcuatis ad apicem convergentibus; elytris striâ suturali in dimidio anteriore longitudinis desinente, punctis seriatis elongatis, illis intervallorum subtilissimis, densissimis, sed punctis perparum fortioribus sat numerosis; metasterno foveâ posteriori parvâ, sulco haud profundo; abdominis segmentis, præcipue in ♂, medio deplanatis et impressis.

Long. corp. 2·4–2·6 mm.

Varying somewhat in size, but much the largest species of the genus; much more ovoid and less parallel-sided,

Fig. 34.



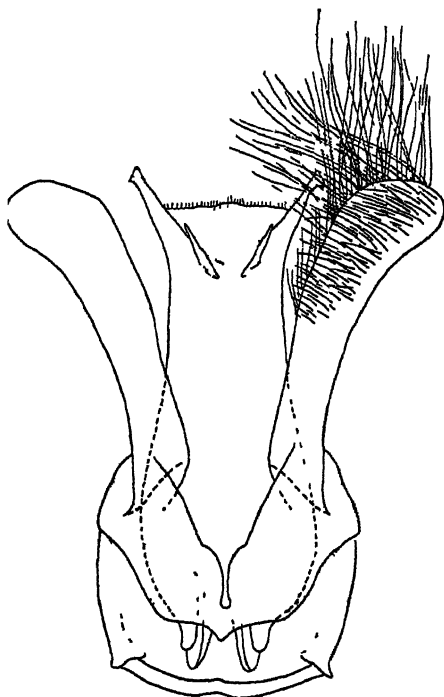
Nesotheca maxima.

Outline, $\times$ ca. 14, and fragments of surface of prothorax and elytra, $\times$ 50.

dorsal surface conspicuously convex, subhumeral calli less developed than in any other species; colour pitchy-black, surface smooth and shining, pubescence greyish-yellow, so arranged that the series of punctures on the elytra appear (under a hand-lens) as well-marked lines. *Prothorax* with

the punctures very fine and sparse, much smaller and sparser than in any other species, with the interstitial punctulation excessively fine and close, and with no basal line. *Scutellum* with sides arcuate, but converging to an apex. *Elytra* with sutural stria vanishing at about the middle of their length, absent in the anterior half; seriate punctures elongate, those of a series separated by a distance about equal to their own length, or greater; intervallar punctulation extremely

Fig. 85.

*Nesothea maxima.*

Aedeagus (hairs omitted on one side), $\times$ ca. 113.

fine and close, with scattered, slightly stronger points rather numerous, especially in the scutellar region. *Metasternum* (see fig. 21 δ) with the posterior pit much smaller than in any other species, and the groove extending back from it shallow and widening; punctuation on either side of it strong and fairly close, finer in the middle in front, surface bare of pubescence except right at the sides. *Ventral abdominal*

segments flattened and slightly impressed in the middle in the ♂, less so in the ♀.

Ædeagus (three examples examined) with lateral lobes broad, at the apex much dilated and obliquely subtruncate, and with the distal portion very densely hairy on both surfaces; basal piece dorsally with a deep narrow cleft which is slightly dilated at the bottom, and with only a blunt proximal angle (not a spine); median lobe flask-shaped, narrowing considerably distally, then produced into two slender diverging horns hooked at the extremity, and with the extreme apex formed by a thin transparent lamina, sharply demarcated from the pigmented portion; spines on the internal sac rather short, thin, and weak. This ædeagus seems to resemble most that of *N. communis* (fig. 32), especially in the form of the median lobe and its horns.

Loc. Seychelles: Silhouette, Mahé. Silhouette: Marc aux Cochons and forest above, over 1000 feet, ix. 1903, 8 specimens. Mahé: 1 example from Mare aux Cochons district, about 1000–2000 feet, i.–ii. 1909, and 1 example the exact locality of which is doubtful.

This species is comparatively well defined by its external characters (large size, ovoid form, reduced calli, very small posterior metasternal pit, etc.). Relatively little difficulty was experienced in assigning to it 10 specimens; of them it only seemed necessary to dissect 4, which proved to consist of 3 ♂♂ and 1 ♀.

23. *Nesotheca tenasserimensis*, sp. n.

Suboblonga, sat lata, lævis, fortiter nitida, piceo-ferruginea, pubescentiâ albidâ vestita; capite sat dense punctato, interstitiis subtilissime punctulatis; prothorace punctis majoribus sat subtilibus ac sparsis, interstitiis subtiliter punctulatis, margine basali distincte elevato; elytris callis subhumeralibus modice prominulis, punctis seriatis haud profundis, in seriebus ad suturam magis regularibus et magis approximatis, in seriebus exterioribus parum elongatis, minus regularibus et magis distantibus, intervallis subtiliter punctulatis, punctis aliquibus parum fortioribus.

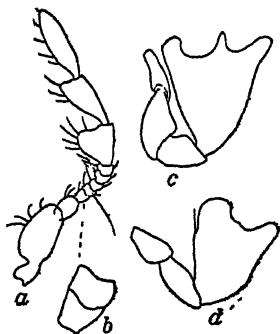
Long. corp. 1·7 mm.

Suboblong, rather broad and short, surface smooth and strongly shining, colour pitchy-ferruginous, darkest on the basal half of the elytra and at the base of the prothorax, pubescence whitish. *Head* with larger punctures about once to twice their own diameter apart, and interstices extremely finely punctulate. *Antennæ* and *palpi* discussed

from the Seychelles.

above (p. 388). *Prothorax* strongly narrowed from base to front margin, sides (viewed from above) very slightly concave; viewed from the side, the hind angle is greater than a right angle, and rounded off at the apex, front angle

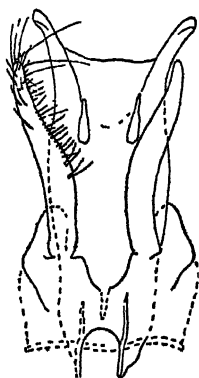
Fig. 36.



Nesotheca tenasserimensis.

a, antenna, $\times 85$; *b*, segments 3 and 4 of antenna; *c*, maxillary palp; *d*, labial palp. *b*, *c*, *d*, all $\times 175$.

Fig. 37.



Nesotheca tenasserimensis.

Aedeagus (hairs omitted on one side), $\times$ ca. 113.

deflexed, rather sharply produced forwards, less than a right angle, rounded at apex; basal margin distinctly elevated; surface with larger punctures relatively fine, rather sparsely and irregularly placed, often several times their own

diameter apart, interstices finely punctulate. *Scutellum* about as long as its breadth at the base, sides arcuate but with some indication of a sharp apex. *Elytra* with subhumeral calli moderate; seriate punctures shallow, those in the series nearest the suture closer and more regular, less than their own diameter apart, those in the outer series slightly elongate, irregularly and less closely placed; intervals finely punctulate, with scattered stronger points; subsutural stria not discernible. *Metasternum* with its posterior part very short, rather sparsely and finely punctured, with a rather big pit towards the front. *Ventral abdominal segments* strongly punctured, the punctures from less than, to about twice, their own diameter apart, interstices extremely finely punctulate.

Ædeagus with lateral lobes sinuate, especially distally on the inner side, narrowing in their distal half to a bluntly-rounded extremity; median lobe broadest at about the middle, narrowing slightly beyond this, then produced into two rather long, divergent horns, rounded at their extremity, not hooked, but with a very slight bulge on the outer side of the extremity, and a ridge running obliquely downwards and inwards from this bulge; the two spines on the internal sac with a constriction just beyond the middle of their length, and their distal extremity sharp; the basal parts of the *ædeagus* were unfortunately somewhat distorted in preparation, and are only indicated by dotted lines as nearly as possible in the figure.

Loc. Tenasserim; "Vict^a Pt" (? Victoria Point), 1 ♂ (*Doherty*; in Brit. Mus., Fry Collection, no. 62,524).

METATHECA, gen. nov.

Genus formâ et structurâ externâ *Nesothecæ* simillimum, sed pubescentiâ longiore, semi-erectâ; oculis antice truncatis, vix sinuatis; antennarum segmentis 5-7 haud serratis; palporum maxillarium et labialium segmentis ultimis haud emarginatis, apice subtruncatis; formâ ædeagi omnino differente.

Form and external structure closely similar to those of *Nesotheca*. In the unique species of *Metatheca*, the large prothoracic punctures are much closer than in any species of *Nesotheca*, the surface of the elytra is more decidedly rugulose, and the pubescence is longer, coarser, and semi-erect. *Head* similarly constructed to that of *Nesotheca*, deeply excavated beneath behind the mentum. *Eyes* truncate, with a slight indication of sinuation, in front. *Antennæ* (fig. 38 a) 10-segmented, very similar in form, but segments 5-7 are

not at all produced or serrate on the inner side. *Labrum* and *mandibles* closely similar (the apical tooth of the mandible is rather more slender, the space between it and the second tooth wider, than in the form shown in fig. 19 *b*). *Maxillæ* and *labium* also closely similar, except that the terminal segments of the palpi are not (respectively) deeply bi-emarginate or emarginate, but are as shown in fig. 38 *b, c*, subtruncate at the apex, with very slight sinuation towards the outer angle. *Prothorax* very similar in form; the difference in punctuation has been mentioned above. *Scutellum* with sides arcuate, about as long as its breadth at the base. *Elytra* of the same form and with the same type of sculpture; moderately prominent subhumeral calli, series of large punctures on the disc, and numerous very fine punctures on the intervals. *Hind wings* normally developed. The structure of the *underside* is closely like that of *Nesotheca*;

Fig. 38.

*Metatheca rugulosa.*

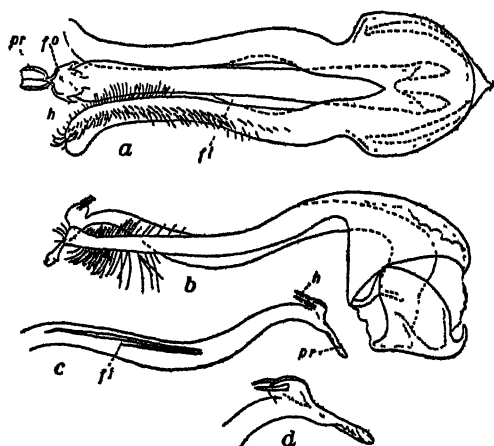
a, antenna, $\times 50$; *b*, maxillary palp; *c*, labial palp.
b and *c*, $\times 85$.

prosternum forming only a very thin lamina between the front coxæ; *mesosternum* invisible when the parts are retracted; the *metasternum* has an anterior lobe of the same form, and anterior and posterior pits filled with hairs (in the unique species the posterior pit is small, pushed right forward almost into the narrow base of the anterior lobe, and the groove extending back from it to the hind margin is deep and very narrow, almost linear); the *ventral abdominal segments* are five, constructed and sinuated as in *Nesotheca*.

The *ædeagus* (three examples examined) is extremely different from any form of that organ found in *Nesotheca*, and this great difference has been one of the main factors in inducing me to constitute *Metatheca* a separate genus. Instead of being a flat, rather wide organ, it is long and

narrow, and in profile retort-shaped, with the basal part bent ventralwards almost at a right angle to the distal, and the distal part—especially the median lobe—very sinuous. It is bilaterally symmetrical (fig. 39 *a* is asymmetrical, owing to the great difficulty of getting the organ to lie evenly in the balsam). The *lateral lobes* in dorsal view recall the sides of a lyre; they bear distally a number of rather short, bristly hairs, directed for the most part either obliquely upwards and outwards, or (on the ventral side) downwards and inwards; in profile the apical part of either lobe is seen to be produced vertically upwards as a thin subangulate

Fig. 39.

*Metathea rugulosa.*

Aedeagus: *a*, dorsal view (hairs omitted on one side); *b*, lateral view; *c*, lateral view, distal part of median lobe, freed from lateral lobes: all $\times 85$. *d*, apex of median lobe, $\times$ ca. 147. Lettering explained in text.

lamina. There is no very clear line separating the lateral lobes from the basal piece, at least not dorsally; the dorsal cleft between the bases of the lateral lobes runs down to a point. The form of the dorsal and ventral portions of the *basal piece*, and the wide gaps, bridged by membrane, which exist between them in front and behind, are best shown in profile; these dorsal and ventral portions are chitinous and pigmented throughout, but the chitin is thickened in parts, in such a way as to form dorsally a pattern resembling a sponge-work; this is not indicated in fig. 39 *a*, but in

fig. 39*b* (profile) the thickenings are just indicated by finely-dotted lines. Form of *median lobe* best explained by the figures; it has on each side, just proximal to the middle of its length, two flanges (fig. 39, *fl*) which fit into grooves on the inner side of the lateral lobe, so that median and lateral lobes are thereby closely coadapted; at the apex is a projection (fig. 39, *pr*), appearing in profile beak-like, but in plan as a trident-shaped piece, the edges of which are composed of pigmented chitin, while the intervening part is colourless; just proximal to this, and dorsal, is a curious hood-like erection (also nearly transparent, but with thickened pigmented edges), open dorsally, and with two backward-directed horns (fig. 39, *h*) arising one from each lateral wall of the hood; the foramen at the apex of the median lobe (fig. 39, *fo*) is clearly discernible in dorsal view, by focussing down through the hood-like erection, inside which it appears to open (though on this last point I cannot be quite sure). No trace of an *internal sac* has been seen.

Type of the genus: *Metathea rugulosa*, sp. n.

24. *Metathea rugulosa*, sp. n.

Sat angusta et elongata, elytrorum lateribus fere parallelis, horum dorso haud fortiter convexo, callis subhumeralibus prominulis, prothoracis lateribus (desuper visis) vix sinuatis; piceo-brunnea, parum opaca, pubescentia flavescente; capito prothoraceque fortiter densius punctatis; elytris striâ suturali tenui, sat indistinctâ, antice circa in $\frac{1}{2}$ longitudinis obsoletâ; punctis soriatis sat magnis, circularibus, illis intervallorum subtilissimis, densis; superficie omni reticulatim rugulosâ.

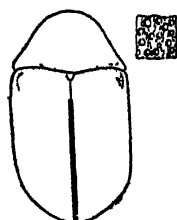
Long. corp. 1.7 mm.

Form relatively long and narrow, elytra parallel-sided, sides of prothorax (viewed from above) very little sinuate, dorsum of elytra not strongly convex, subhumeral calli prominent; colour dark pitchy-brownish, surface rather dull (in denuded examples appearing moderately shining), the long semi-erect pubescence yellowish. *Head* very strongly and very closely punctured, the punctures almost touching, leaving very little room for the very fine interstitial points. *Prothorax* almost as closely punctate, but with little groups of very fine interstitial points between the punctures; hind margin a little elevated towards the hind angles, scarcely at all in the median part, but with no definite basal line. *Scutellum* raised at its edges above the level of the adjacent part of the elytra. *Elytra* with a

fine, rather indistinct, sutural stria, obsolete in about the anterior $\frac{1}{2}$ of their length; scriate punctures rather large, circular, those of a series separated only by a distance equal to their own diameter, or less; the intervallar punctulation is close and exceedingly fine, and the entire surface is rugulose, producing from some aspects the effect of a reticulation. Posterior part of *metasternum* coarsely and closely punctured, *ventral abdominal segments* also strongly and closely punctured. The form of the metasternal posterior pit and groove, and the *ædeagus*, are described under the genus.

Loc. Seychelles. Silhouette, Mahé. Silhouette: Mare aux Cochons and high forest above, about 1000–2000 feet, ix. 1908. Mahé: high forest of Morne Blanc and Morne Pilot, nearly 2000 feet, xi. 1908; high damp forest between Trois Frères and Morne Seychellois, about 1500–2000 feet,

Fig. 40.

*Metatheca rugulosa.*

Outline, $\times$ ca. 14, and fragment of surface of prothorax, $\times$ 50.

xii. 1908; slopes of Morne Seychellois, about 1500–2000 feet, 4. ii. 1909. 12 examples in all; a species evidently associated with the most elevated and dampest endemic forests.

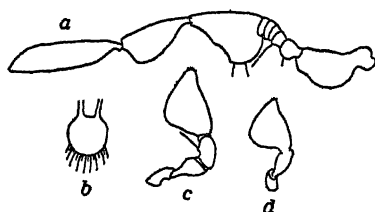
In point of purely superficial resemblance, this insect comes closest to *Nesotheca lateoblunga*, which also has the elytra rugulose; but the much narrower form, long and semi-erect pubescence, and coarse and very close prothoracic punctuation (as well as the structural characters presented by antennæ and palpi) readily distinguish *M. rugulosa*. Another feature which is very apparent in some specimens of *Metatheca*, and which I think may be constant, is the very marked depression of the general level at the junction of the prothorax and elytra; the convexity of the dorsum of the prothorax slopes down to its base, and there is then at the base of the elytra a sharp upward slope to a level higher than that of the prothoracic dorsum.

PARATHECA, gen. nov.

Genus *Nesotheca* (antea, p. 386) simillimum, sed differt in formâ antennarum, palporum, ædeagi. Antennæ 9-segmentatæ, segmentis 2-6 brevibus (4-6 brevissimis), clavâ elongatâ. Palpi maxillares et labiales segmento ultimo margine apicali integro. Ædeagus infra descriptus est.

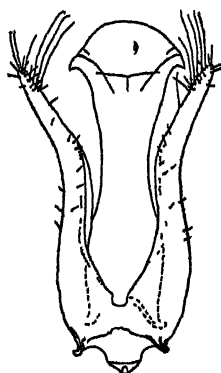
Closely resembling *Nesotheca*, but with antennæ (fig. 41 *a*) 9-segmented, segments 2-6 being very short and very slightly

Fig. 41.

*Paratheca borneensis.*

a, antenna, $\times 50$; *b*, labrum; *c*, maxillary palp; *d*, labial palp.
b, *c*, *d*, $\times 85$.

Fig. 42.

*Paratheca borneensis.*

Ædeagus, $\times$ ca. 113.

produced on the inner side, and the club-segments being very long, segment 7 having its distal margin shallowly bisinuate. Labrum (fig. 41 *b*) as broad as long, distal margin

arcuate. *Mandibles* of the same general form as in *Nesotheca*, but the apical tooth is rather long and slender. *Maxillæ* and *labium* of the same general form as in *Nesotheca*, but the palpi have the terminal segment (fig. 41 c. d) entire, not emarginate or bi-emarginate. *Hind wings* fully developed. Structure of underside closely resembling that of *Nesotheca*; *metasternum* with an anterior lobe of the same form, with lateral expansions, a deep pit, and an anterior elevated tubercle; posterior metasternal pit deep and placed rather far back*.

Ædeagus closely similar in general form to that of *Nesotheca*, but less flattened dorso-ventrally, the median lobe being curved ventralwards at about the middle of its length and somewhat bent up dorsalwards towards the apex; it is not possible to show this curvature in fig. 42, in which also the asymmetrical position of the lateral lobes is an accident of the preparation; the *lateral lobes* appear to be grooved on the inner side towards the base, so that the median lobe fits into them, but with the single specimen available for dissection it has not been possible to make out the exact details of this grooving; in the downward curve of the median lobe about the middle of its length, and the co-adaptation of median and lateral lobes, this ædeagus recalls that of *Metathea* (fig. 39), though it has nothing approaching the retort-shaped profile or complicated apex of the median lobe which are found in *Metathea*. The two stout spines on the internal sac, which are so conspicuous a feature in *Nesotheca*, are completely absent in *Parathea*; in the single preparation of the ædeagus of the latter there is a transparent, finely membranous portion with arcuate outline, projecting between the "horns" at the apex of the median lobe, and perhaps caused by the internal sac being partly everted. [The modified abdominal segments in relation with the ædeagus, which in repose are retracted within the abdomen, are also closely similar in form to those of *Nesotheca*.]

Type of the genus: *Parathea borneensis*, sp. n.

25. *Parathea borneensis*, sp. n.

Late ovata, convexa, lateribus arcuatis, obscure fusca, parum opaca, pubescentiâ tenui, brevi, decumbente, flavo-albidâ vestita;

* When the ventral abdominal segments are removed, the metasternum appears cleft from the hind margin for some distance forward.

prothorace modice fortiter sat dense punctato, interstitiis subtilissime punctulatis, lineâ subbasali nullâ; elytris callo subhumerali modice elevato, striâ subsuturali nullâ, punctis seriatis magnis, ovalibus, illis intervallorum modice fortibus, sat densis, interstitiis subtilissime punctulatis; metasterno et segmentis ventralibus abdominis fortiter dense punctatis.

Long. corp. ca. 2 mm.

Broadly ovate, reaching its greatest breadth a little before the middle of the length of the elytra, which are arcuate at the sides; dark fuscous, rather dull, clothed with fine, short, closely decumbent, yellowish-whitish pubescence. *Prothorax* with moderately large punctures, appearing under a high power as small circles, about once to twice their own diameter apart, and with extremely fine, close, interstitial punctulation; with no subbasal line; seen in side-view, with front angles much deflexed, acute, and hind angles greater than a right angle and rounded off. *Scutellum* about as long as its breadth at the base, with sides and hind margin curved; almost impunctate. *Elytra* with moderately prominent subhumeral callus; with the seriate punctures large, oval, those of each series very close, separated by much less than their own diameter; intervals with moderately large, circular punctures, less than twice their own diameter apart, and with the interstices extremely finely punctulate, so that the whole surface of the elytra has a very closely punctured, and in some aspects a subrugulose, appearance; I have not discerned any subsutural stria, even behind. *Metasternum* and *ventral abdominal segments* with large, strong, very close, circular punctures; segments 2, 3, 4 subequal in length in the middle, their hind margins slightly sinuate in the middle; 5 nearly as long as 3 and 4 together.

Loc. Borneo: in Coll. Brit. Mus., 56-152, 2 examples (one, the *type*, of undetermined sex; the other, *paratype*, ♂, dissected and parts figured).

26. *Parathea assamensis*, sp. n.

♀. Multo minor, angusta, suboblunga; obscure rufo-brunnea, antennis dilutioribus, parum nitida, pubescentiâ pallidâ, decumbente, vestita; prothorace antice sat elongato, dense punctato, interstitiis subtilissimo punctulatis; elytris transverse rugosis, callo subhumerali modice elevato, interstitiis subtilissimo punctulatis.

Long. corp. ca. 1.3 mm.

Much smaller than the preceding, relatively very narrow, suboblong, elytra nearly parallel-sided; dark reddish-brown, slightly shining, with pale pubescence, and antennæ lighter reddish-brown. *Head* with larger shallow punctures, often less than their own diameter apart, and interstices finely punctulate. *Antennæ* formed much as in *P. borneensis* (cf. fig. 41), in the single balsam-preparation segment 3 is more strongly produced on the inner side. *Maxillary* and *labial palpi* much as in *P. borneensis*, in the single balsam-preparation of each the outer apical angle of the terminal segment is perhaps a little more produced. *Prothorax*, viewed from above, rather long, strongly narrowed to the front, with basal margin distinctly elevated, larger punctures only about their own diameter apart (or even less), interstices finely punctulate; viewed from the side the hind angle is broadly rounded off, the front angle is deflexed and also appears rounded, and the long curve of the front margin (due to the prolongation of the prothorax in the middle in front) is shallowly sinuate on either side in front of the front angle. *Scutellum* nearly truncate behind. *Elytra* strongly rugose transversely, channel-like depressions (which sometimes fork) extending transversely between the large seriate punctures; interstices finely punctulate; subsutural stria not discernible; subhumeral calli rather well marked. *Hind wings* not examined. *Underside* closely resembling that of *Nesotheca*; *metasternum* with large strong punctures, its posterior part (behind the anterior lobe) with a deep median groove throughout its length, but with no pit; abdominal segments with large, shallow, almost contiguous punctures.

Loc. Assam: Potkai Mountains (*Doherty*), 1 ♀ (in Brit. Mus., Fry Collection, no. 61,235).

Although this insect is represented only by a single ♀, and in consequence I have seen no aedeagus of the species, yet it conforms so closely to *Parathea* in general structure, form of antennæ, palpi, sterna, &c., and in possessing the double punctuation of large punctures and fine interstitial points, that it is at present referable only to this genus. In specific characters it is so distinct that I describe it without hesitation, the small size, narrow form, rugose elytra, and prolongation of the prothorax in front, separating it widely from *P. borneensis*.

XI.III.—*The Hemiptera-Heteroptera of Rodriguez, together with the Description of a new Species of Cicada from that Island.* By W. E. CHINA, B.A.

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THE material on which this paper is mainly based forms part of the large collection of insects made in Rodriguez by Mr. H. P. Thomasset and Mr. H. J. Snell between August and November, 1918, and presented in 1919 to the University Museum of Zoology, Cambridge. A list of reports previously published on this collection was given by Hugh Scott in an introductory note to F. W. Edwards's account of the DIPTERA NEMATOCERA of the island (Ann. & Mag. Nat. Hist. (9) xii. p. 330, 1923). Since then a paper by Mr. E. Myrick on the MICRO-LEPIDOPTERA has appeared (Trans. Ent. Soc. London, 1923, parts iii.-iv. p. 544 (April 1924)). The present paper deals with all the HEMIPTERA-HETEROPTERA, and with the only species of *Cicada* in the collection. The FULGORIDÆ have already been worked out by Mr. Frederick Muir, and it is hoped that his report will shortly be published, and that articles on the PSYLLIDÆ and JASSIDÆ by other writers will follow.

A small collection of HEMIPTERA was made at Rodriguez by George Gulliver whilst accompanying the 'Transit of Venus' Expedition to the Island in the autumn of 1874. These specimens were described by Butler in the 'Philosophical Transactions of the Royal Society' (extra volume clxviii.) in 1879, the new species having been previously described in the Ann. & Mag. Nat. Hist. (4) xvii. p. 411 (1876). This collection included specimens of sixteen species of HETEROPTERA and three of HOMOPTERA, now in the British Museum. In the following description of the collection made by Messrs. Thomasset and Snell in 1918, reference is made to Gulliver's specimens, and Butler's determinations are emended in certain cases, thus making the paper a more complete account of the HETEROPTERA of the island. Fifty-two species are now recorded, including thirteen species and two genera hitherto undescribed from any other locality. The TYPES of the new species described below have been placed in the British Museum.

Suborder HETEROPTERA.

Family Cydnidæ.

1. *Macroscytus privignus*, Horv.

Ann. Mus. Nat. Hungarici, xvii. p. 237 (1919).

Originally described from Madagascar.

1 ♂. 1 ♀. September.

2. *Geotomus proximus*, Sign.

Ann. Soc. Ent. France, 1883, p. 54, t. 4. fig. 163.

Recorded from Réunion and Seychelles.

7 ♀ ♀, August and September.

Family Pentatomidæ.

3. *Nezara viridula*, L.

Cimex viridula, L., Syst. Nat. ed. x. p. 414 (1758).

Nezara viridula, Stål, Hemipt. Afr. i. p. 193 (1864).

Cosmopolitan.

1 ♂, 5 ♀ ♀; 1 ♀ (*Sinclair*); 1 ♀ (*Gulliver*).

4. *Antestia mauritii*, Stål.

Pentatoma mauritii, Stål, Eugen. Resa, Ins. 1859, n. 227.

Antestia mauritii, Stål, Hemipt. Afr. i. p. 204 (1865).

Recorded from Mauritius and Mozambique.

1 ♂, 2 ♀ ♀, August.

5. *Bathycælia flavolimbata*, sp. n.

♂. *Head* pale testaceous, finely punctate, sides sinuate—length 3.1 mm., width between base of eyes 2.1 mm.; eyes dark brown, ocelli red, twice as far from one another as from the eye; antennæ pale testaceous with the fourth, fifth and apical half of the third joint rufo-testaceous and densely covered with short stiff hairs—length of joints 0.8, 1.5, 2.4, 2.5, and 2.3 mm.; rostrum very long, extending to the extreme apex of the abdomen, pale olivaceous with the apex black—length of joints 2.0, 3.7, 5.3, and 3.0 mm. *Pronotum* pale olivaceous shading to rufo-testaceous posteriorly, strongly punctate, lateral margins slightly convex almost straight, posterior margin distinctly concave; length in middle 3.3 mm., width across posterior angles 3.2 mm. *Scutellum* strongly punctate, rufo-testaceous with the basal half olivaceous and the apex obscurely pale testaceous; basal angles yellow, each with a black foveate impression. *Hemelytra* rufo-testaceous, punctate, membrane pale fuscous extending slightly beyond the apex of the abdomen. *Abdomen* broader than the hemelytra, connexivum bright yellow with the interior margin broadly sanguineous, the exterior margin narrowly testaceous. *Legs* testaceous with the tarsi and the apices of the tibiæ darker.

Total length 15 mm.

Near *B. prælongirostris*, Bergr., from Seychelles, but

rather smaller and narrower and much more strongly punctate. The genitalia are quite distinct from those of the Seychelles species.

2 ♂♂ and 4 larvæ, November.

6. *Phricodus hystrix*, Germ.

Aradus hystrix, Germ., Silb. Rev. Ent. v. 1837, p. 134.

Phricodus hystrix, Spin., Rev. Mag. Zool. 1839, p. 331.

Recorded from Nyasaland, Tanganyika Territory, S. Africa, Madagascar, Mauritius, and S. India.

4 ♂♂, 5 ♀♀, and 2 larvæ, September and October; 1 ♂, 2 ♀♀ (*Sinclair*); 1 ♂, 1 ♀ and 2 larvæ (*Gulliver*).

The collection of Thomasset and Snell contains larvæ of two more species of Pentatomidæ at present indeterminable.

Family Coreidæ.

7. *Leptoglossus membranaceus*, F.

Cimex membranaceus, F., Spec. ii. p. 351, 79 (1781).

Leptoglossus membranaceus, Stål, Kongl. Sv. Vet.-Ak. Handl. xi. no. 2, p. 68 (1873).

Widely distributed over Africa, India and Malaya.

4 ♂♂, 4 ♀♀, and 2 larvæ, August and September.

8. *Acanthomia horrida*, Germ.

Syromastes horrida, Germ., Silb. Revue, v. p. 145 (1837).

Acanthomia horrida, Stål, Kongl. Sv. Vet.-Ak. Handl. xi. no. 2, p. 83 (1873).

Recorded from S. Africa, Mauritius, and Seychelles.

2 ♂♂ and 3 ♀♀.

9. *Stenocephalus punctipes*, Stål.

Kongl. Sv. Vet.-Ak. Handl. xi. no. 2, p. 85 (1873).

Recorded from Madagascar and Seychelles.

2 ♀♀, September; 1 ♀ (*Sinclair*).

10. *Cletus ochraceus*, H.-S.

Gonocerus ochraceus, H.-S., Wanzen Ins. vi. p. 7, fig. 563 (1837).

Cletus ochraceus, Stål, Hemipt. Afr. ii. p. 77 (1865).

Originally described from Cape Colony.

2 ♂♂, 4 ♀♀, and 1 larva, August and September.

11. *Liorhyssus hyalinus*, F.*Lygæus hyalinus*, F., Ent. Syst. iv. p. 168, 115 (1794).*Coreus hyalinus*, F., Syst. Rhynch. (1803), p. 201.*Corizus (Liorhyssus) hyalinus*, Stål, Kongl. Sv. Vet.-Ak. Handl. ix. p. 222 (1870).*Liorhyssus hyalinus*, Stål, *tom. cit.* xi. no. 2, p. 98 (1873).

Cosmopolitan.

4 ♀ ♀, September.

12. *Serinetha hæmatica*, Germ.*Leptocoris hæmatica*, Germ., Silb. Rev. Ent. v. p. 144 (1837).*Serinetha hæmatica*, Dall., List Hemip. ii. p. 463 (1852).*Serinetha lateralis*, Sign., Ann. Soc. Ent. France, (3) viii. p. 939 (1861).

Recorded from S. and W. Africa, Madagascar, Mauritius, and Seychelles.

8 larvæ and 1 teneral adult (*Gulliver*).

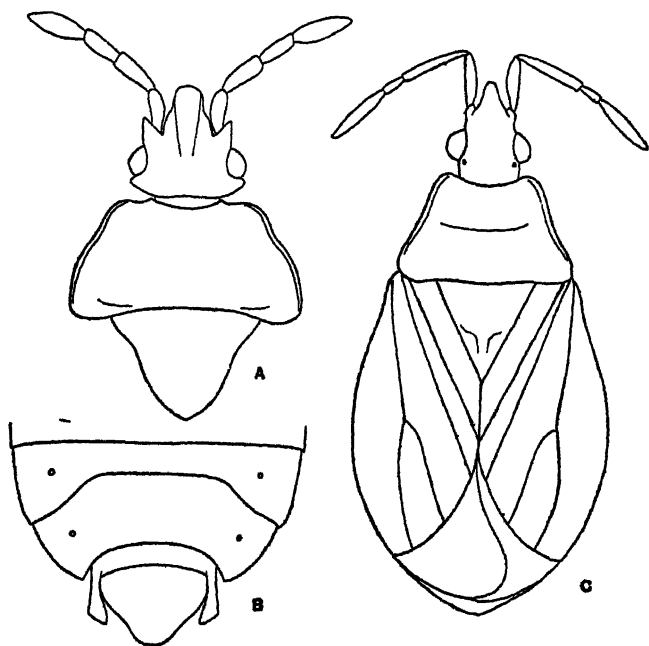
Family Dysodiidæ.

13. *Mezira gulliveri*, sp. n. (Fig. 1, A & B.)*Mezira caffra*, Butl., nec Stål, Phil. Trans. Roy. Soc. clxviii., Hemipt. p. 550 (1879).

♂. *Head* dark ferruginous (tylus castaneous), densely granulate, rather longer than wide (including eyes), length 0.77 mm.; anterior process extending a little beyond the apex of first antennal joint; post-antennal teeth bluntly pointed, extending about one-third the length of the first antennal joint; postocular teeth just reaching lateral margin of eyes, rounded and little prominent; rostrum ochraceous, extending to base of head—that is, very slightly longer than rostral sulcus; antennæ moderately thickened, sparsely covered with very short depressed hairs which are longer and much more numerous on the fourth joint, ferruginous with the extreme bases and apices of the first, second, and third, and the apical half of the fourth ochraceous; second joint longer than the third, length of joints 0.28, 0.32, 0.16, and 0.37 mm. *Pronotum* ferruginous, granulate, the lateral margins and posterior lateral angles obscurely ochraceous; lateral margins moderately sinuate and narrowly carinate; posterior margin broadly emarginate; length in middle 0.66 mm., width across posterior margin 1.6 mm. *Scutellum* dark ferruginous, rugosely granulate, subtriangular, the lateral margins slightly concavely sinuate anteriorly and convexly sinuate posteriorly (length 0.82 mm., width at base 1.2 mm.). *Corium* ferruginous, membrae pale yellowish at

the base, remainder fuscous, distinctly reticulately veined, veins black and shining. *Abdomen* below distinctly convex, castaneous, smooth and shining on the disc, obscurely granulate laterally, the spiracles placed equidistantly from the anterior and posterior margins of the ventrites; posterior margin of fifth ventrite broadly but deeply emarginate; connexivum sloping downwards from the disc of the abdomen above, thus exhibiting a bevelled appearance, ferruginous, finely granulate, with the lateral margin broadly

Fig. 1.



A. *Mezira gulliveri*, sp. n., head and pronotum; B. Ventral view of apical segments of abdomen. C. *Clerada minuta*, sp. n.

and the posterior margin narrowly castaneous, the second, third, fourth, and fifth segments with two pale scale-like spots, the sixth with one. *Prosternum* dark ferruginous, thickly granulate; meso- and metasterna dark ferruginous, granulate laterally, but on the disc simply and finely rugose, a central narrow longitudinal band on the metasternum and the posterior third of the mesosternum castaneous and smooth. *Legs* ochraceous with the femora except at their

extreme apices ferruginous and granulate (especially the fore femora), but not dentate.

Total length 4.8 mm.

♀. Similar to ♂, but slightly broader and larger. Posterior margin of fifth ventrite bisinuate.

This species seems to vary somewhat in size, one ♂ measuring 5 mm. and a ♀ 6 mm. in length. Two specimens exhibit oligomery of the right-hand antenna.

7 ♂♂ and 3 ♀♀ (*Gulliver*).

Butler referred these specimens to *Mezira caffra*, Stål (now *Neuroctenus caffer*), from S. Africa and Madagascar, but the species is undoubtedly a true *Mezira*.

Family Lygæidæ.

Subfamily LYGÆINÆ.

14. *Graptostethus servus*, F.

Lygæus servus, F., Mant. Ins. ii. p. 300 (1787).

Graptostethus servus, Stål, Kongl. Sv. Vet.-Akad. Handl. xii. no. 1, p. 117 (1874).

Extends throughout African and Oriental Regions.

5 ♂♂, 2 ♀♀, September.

15. *Cænocoris nerii*, Germ.

Lygæus nerii, Germ., Faun. Eur. xxiv. p. 17 (1817).

Cænocoris nerii, Fieb., Eur. Hem. p. 166 (1861).

Previously only recorded from the Mediterranean Region and N.W. India (Sind).

1 ♀, September.

16. *Nysius euphorbiæ*, Horv.

Ann. Mus. Nat. Hungarici, viii. p. 11 (1910).

Recorded from Mauritius and Seychelles.

2 ♂♂, 7 ♀♀, August to November.

17. *Nysius albipennis*, Dist.

Trans. Linn. Soc. Lond. (2nd ser., Zool.) xvi. 2, p. 149 (1913).

Described from Seychelles and Aldabra.

9 ♂♂, 6 ♀♀, August to October.

Subfamily APHANINÆ.

18. *Paromius apicatus*, Stål.

Rhyparochromus apicatus, Stål, Öfv. Vet.-Ak. Förh. 1855, p. 84.

Plociomeria apicatus, Stål, Hem. Afr. ii. p. 157 (1865).

Paromius apicatus, Stål, Kongl. Sv. Vet.-Ak. Handl. xii. no. 1, p. 148 (1874).

Recorded from Natal, Mauritius, and Seychelles.

1 ♂.

19. *Paromius gracilis*, Rmb.

Stenogaster gracilis, Rmb., Faune Ent. Andalousie, 1842, p. 139.

Paromius gracilis, Fieb., Eur. Hemipt. 1861, p. 171.

Plociomereus seychellesus, Walk., Cat. Het. v. p. 120 (1872) [n. syn.].

This widely distributed S. Palaearctic species has also been recorded from Seychelles, Sierra Leone, S. Africa, and Madagascar. [Distant has synonymised *P. seychellesus*, Walk., with *P. pallidus*, Montr.]

1 ♂.

20. *Pamera vineta*, Say, var. *capicola*, Stål.

Pamera vineta, Say, New Harm. Ind. 1831.

Plociomera parvula, Dall., var. *a*, Stål, Hem. Afr. ii. p. 159 (1865).

Pamera capicola, Stål, Kongl. Sv. Vet.-Ak. Handl. xii. no. 1. p. 148 (1874); Reuter, Ent. Tidskrift, 1887, p. 96.

**Pamera lounsburyi*, Dist., Trans. S. African Phil. Soc. xiv. p. 435 (1904) [n. syn.].

This species is distributed throughout the tropical and subtropical regions of the world, but var. *capicola*, Stål, has only been recorded from the Cape and Madagascar.

2 ♀ ♀.

21. *Pamera ebenavi*, Reut. ?

Ent. Tidskrift, 1887, p. 96.

Description based on one female from Madagascar.

2 ♂ ♂, September.

These specimens are most probably males of Reuter's species, and agree very closely with his description of the female. The anterior tibiae are, however, slightly curved, and are armed in the middle with a small spine as in the male of *P. annulipes*, Bür. The intermediate tibiae also possess a minute spine in the middle.

22. *Dieuches lateralis*, Sign.

Dieuches lateralis, Signoret, in Maillard's Notes sur l'île de la Réunion (Annexe J, Hemiptères), p. 29 (1862).

Beosus lateralis, Stål, Hem. Afr. ii. p. 171 (1865).

Dieuches lateralis, Stål, Kongl. Sv. Vet.-Ak. Handl. xii. no. 1, p. 162 (1874).

Described from Réunion.

5 ♀ ♀ and 2 larvæ, September.

* I have taken this opportunity of synonymising Distant's S. African species.

23. *Lethæus longirostris*, Reuter.

Ent. Tidskrift, 1887, p. 102.

Lethæus (?) *tartareus*, Butl., nec Stål, Phil. Trans. Roy. Soc. clxviii., Hemipt. p. 550 (1879).

Recorded from Madagascar, Natal, and Rhodesia.

1 ♂, 4 ♀, and 6 larvæ, August and September.

2 ♂, 1 ♀ (*Sinclair*).1 ♂, 1 ♀, and 3 larvæ (*Gulliver*).24. *Lethæus snelli*, sp. n.

♂. Head black, finely punctate except at the base behind the ocelli; more acute in front than in *L. punctus*, Bergr.; eyes black, ocelli small, colourless, close to the base of the eyes; length in the middle 1.0 mm., width across eyes 1.2 mm., width between the eyes 0.7 mm.; antennæ, first joint castaneous with several bristles 0.6 mm., second pale brown 1.2 mm., third yellow with the base brown 0.9 mm., apical joint yellow 0.8 mm.; rostrum testaceous with the apex black, extending to base of abdomen—length of joints 0.83, 0.83, 0.67, and 0.57 mm. Pronotum black with the posterior margin and angles obscurely castaneous, much less strongly and more regularly punctate than in *L. punctus*, Bergr., with two impunctate areas anteriorly; lateral margins almost straight, without the narrow ampliate border of *L. punctus*, Bergr., and *L. stellatus*, Dist.; length in the middle 1.2 mm., posterior margin 2.2 mm., anterior margin 1.0 mm. Scutellum black, much less strongly punctate than in *L. punctus*, Bergr. (length 1.4 mm.). Hemelytra punctate, dark castaneous, rather paler along the costal margins, with a small pale yellow elongate spot in the middle of the claval margin of the corium and an irregular pale yellow spot on the membranal margin towards the apex; membrane colourless hyaline, extending beyond the apex of the abdomen. Sternum black, punctate, the posterior lateral angle of the prosternum and the posterior margin of the metasternum pale castaneous. Abdomen castaneous, very obscurely punctate. Femora castaneous, tibiæ and tarsi pale testaceous, the tibiæ armed with a few dark bristles.

Total length, including membrane, 6 mm.

♀. Similar to ♂, but larger (length 7 mm.).

7 ♂♂, 10 ♀♀, and 6 larvæ, August and September.

3 ♀♀ (*Sinclair*).

This species differs from both *L. stellatus*, Dist., and *L. punctus*, Bergr., in the straight un-explanate lateral margins of the pronotum and in the apical antennal joint being shorter than the third.

25. *Lethæus stellatus*, Dist.

Trans. Linn. Soc. Lond. (2nd ser., Zool.), xvi. 2, p. 155 (1913).

A single ♂ taken by Thomasset and Snell, although differing slightly from the typical specimens in size and colouring, seems to be referable to this species. It is slightly larger than the type-specimen and the hemelytra are more variegated with ochraceous.

Recorded from Seychelles, Aldabra, and Assumption.

26. *Lanchnophorus guttulatus* Reut.

Ent. Tidskrift, 1887, p. 90. [*Lachnophorus*, Dist., Trans. Linn. Soc. Lond. (2nd ser., Zool.), xvi. p. 153 (1913).]

Described from Madagascar.

3 ♀ ♀, August.

27. *Clerada minuta*, sp. n. (Fig. 1, C.)

♀. Uniformly pale castaneous, strongly and regularly punctate. *Head* as long as pronotum in the middle (0.74 mm.), width between the eyes 0.35 mm.; eyes dark red, granulate, ocelli much less pronounced than in *C. apicicornis*, Sign., and placed not quite so far laterally, being situated slightly behind the posterior inner angles of the eyes; rostrum testaceous, just reaching the anterior coxæ—length of joints 0.26, 0.12, 0.46, and 0.22 mm.; antennæ uniformly pale castaneous, with the second, third, and fourth joints clothed with short pale hairs; first joint slightly incrassate, passing the apex of the head by half its length, fourth fusiform, more incrassate than in *C. apicicornis*, Sign.—length of joints 0.38, 0.44, 0.17, and 0.41 mm.; bucculæ moderately elevated, long, extending almost to the anterior margin of the prosternum. *Pronotum* with the lateral margins less strongly sinuate than in *C. apicicornis*—width 0.61 mm. anteriorly, 1.3 mm. posteriorly. *Scutellum* equilateral—length 0.7 mm. *Hemelytra* broader in the middle than across the base of the scutellum, the costal margin rounded beyond the middle; claval commissure shorter than scutellum, claval suture longer than the apical margin of the corium; clavus with four complete rows of punctures; membrane much reduced, not reaching the apex of the abdomen, opaque and testaceous at base, transparent at the apex. Legs unicolorous with the rest of the insect, unarmed, first joint of hind tarsi distinctly longer than the second and third together, second very short. Total length 3.7 mm., breadth across middle of hemelytra 1.7 mm.

2 ♀ ♀.

I have referred this species to the genus *Clerada*, Sign. It bears some resemblance to *Panchæa*, Stål, but differs in the exserted head.

Family Pyrrhocoridae.

28. *Dysdercus flavidus*, Sign.

Ann. Soc. Ent. France, (3) viii. p. 955 (1860).

Dysdercus fasciatus, Butl., nec Sign., Phil. Trans. Roy. Soc. clxviii., Hemipt. p. 550 (1879).

Recorded from Madagascar, Mauritius, and Mayotte.

3 ♂♂, 3 ♀♀, August and September; 3 ♂♂, 3 ♀♀ (*Gulliver*).

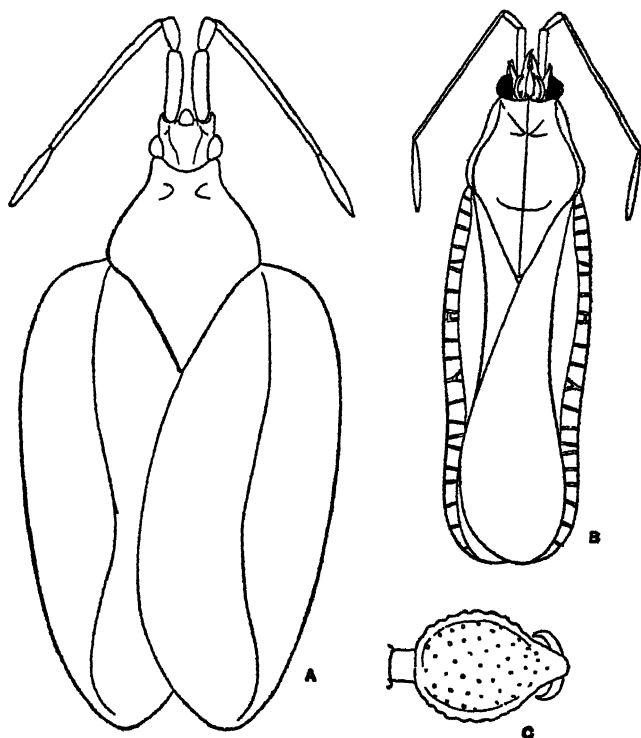
Family Tingitidae.

29. *Teleonemia insularis*, sp. n. (Fig. 2, B.)

♂. Elongate, pale ochraceous. *Head* triangular, pale castaneous, punctate, with nine whitish depressed spines directed anteriorly, including one median posterior spine, two lateral posterior lying along the inner edges of the eyes, two median anterior placed close together between the bases of the antennæ, two lateral anterior placed at the apices of the eyes, and one on the outer side of each of the antenniferous tubercles; eyes black, granulate; antennæ uniformly pale ochraceous—first joint thickened 0.3 mm., second thickened 0.15 mm., third thin 1.0 mm., fourth gradually thickened and clothed with pale hairs 0.5 mm.; bucculæ whitish, well elevated, closed in front, but not produced in front of the apex of tylus; rostrum ochraceous, extending to midway between the intermediate and hind coxæ. *Pronotum* with the lateral margins slightly sinuate, narrowly and uniformly explanate, vertically recurved and not at all reflexed against the dorsal surface of the pronotum; anterior collar (hood) moderately elevated, disc strongly convex, and posterior process about as long as wide at the base, obtusely pointed; median carina distinct, extending from anterior margin to apex of posterior process; lateral carinæ absent; pale ochraceous, densely reticulate on the disc, but with reticulations larger and more distinct on the posterior process; median carina and lateral margins whitish, cicatrices and two lateral longitudinal lines (in usual position of lateral carinæ) pale castaneous; a spot on each side of the median carina towards the apex of the posterior process dark brown. Sternal ridges whitish, distinct, united posteriorly; metasternal orifices moderately distinct. *Hemelytra* narrow,

elongate, extending well beyond apex of abdomen, whitish hyaline, the nervures of the areolets ochraceous, a spot at about the apex of the discoidal area dark brown; costal area narrow, moderately reflexed with a single row of areolets; subcostal area sloping, widest at about one-third its length from the base (nearly twice as wide at this place as the costal area), at the apex very narrow and nearly vertical,

Fig. 2.



A. *Litadea delicatula*, sp. n.; C. Hind tarsus of same.
B. *Teleonemia insularis*, sp. n.

densely areolate, except towards the apex; discoidal area inseparable from the membrane, much less densely areolate than subcostal area, the areolets increasing in size towards the apex of the membrane; nervure separating subcostal and discoidal areas continued to outer angle of apex of hemelytra, strongly defined, almost carinate. *Abdomen*

castaneous; legs pale ochraceous, moderately long, the apical joints of tarsi broadly ovate. Total length 3.2 mm., width of pronotum at widest point 0.8 mm., width of hemelytra at widest point 0.9 mm.

♀. Slightly larger and paler.

8 ♂♂, 7 ♀♀, and 14 larvæ.

LITADEA, gen. nov.

Head smooth, shining, unarmed, triangular, about as long as broad at base including eyes, disc slightly elevated; eyes granulate with the posterior margins touching the anterior border of the pronotum, tylus extending well beyond juga, a tenniferous tubercles large, armed laterally with a short blunt spine or tubercle; antennæ moderately long, basal joint incrassate, cylindrical, a little longer than the head, second joint little more than one-third the length of the first, less incrassate, wider at apex than at base, third joint long twice as long as the first, fourth joint subequal to the first; bucculæ moderately elevated, closed anteriorly, not at all produced in front of apex of tylus, widely separated in the middle and forming a broadly ovate figure when seen from the ventral side; rostrum short, extending only a little beyond the anterior coxæ. *Pronotum*, except for a thin impunctate median line, densely punctate, with the posterior process densely areolate; lateral margins slightly sinuate, evenly rounded, and not at all explanate or carinate; hood obsolete, median and lateral carinæ absent, posterior process moderately short, subequal in length to the rest of the pronotum. Sternal ridges distinct, but very little elevated; metasternal orifices very distinct. *Hemelytra* flattened, extending well beyond the apex of the abdomen, very broad, the costal area very strongly explanate, arching suddenly outwards from the base of the hemelytron almost at right angles to the lateral angle of the pronotum; areas very distinctly separated, the costal and subcostal areas fused, distinctly and regularly areolate; the discoidal area and the membrane fused, the former, however, much more densely areolate than the membrane or the costal areas; the vein separating the discoidal area and membrane from the costal areas rather more distinct than in *Serenthia* and *Lullius*; areolets circular, except along the anal margin. *Legs* rather short, femora longer than the tibiæ, fore femora above more or less suddenly incrassate at the base, but not so much so as in *Serenthia*; tarsi apparently two-jointed, the apical joint broadly ovate, concave below, the cavity filled with short, erect, bristle-like hairs.

Genotype, *Litadea delicatula*, sp. n.

This very distinct genus comes close to *Lullius*, Dist., but differs in the widely explanate costal area and in the longer basal antennal joints.

30. *Litadea delicatula*, sp. n. (Fig. 2, A & C.)

♂ ♀. *Head* pale castaneous, smooth, and shining, eyes black; antennæ with basal joint and apical third of third joint pale castaneous, rather paler than the head, second, fourth, and basal two-thirds of third joint black—length of joints 0.54, 0.20, 1.08, 0.51 mm.; bucculæ whitish; rostrum ochraceous with the apex black, extending slightly beyond the anterior coxæ. *Pronotum* and hemelytra yellowish ochraceous, the costal areas and membrane very pale; pronotal cicatrices pale castaneous. *Abdomen* below dark ochraceous, tinged with olive-green; the sternal ridges and metasternal orifices whitish. Legs pale yellow.

Total length (including hemelytra) 3.9 mm., width of pronotum at widest part 1.0 mm., width of hemelytra at base of costal area 1.9 mm.

9 ♂♂, 2 ♀♀, and 1 larva.

The colouring of the antennæ seems to vary somewhat, possibly due to the degree of maturity. In some the first, second, third, and extreme base of the fourth joint are concolorous with the head, and only the remainder of the last joint is black. In others the second joint is unicolorous with the first, while the basal two-thirds of the third and the fourth are black.

Family Reduviidæ.

Subfamily EMESINÆ.

31. *Ischnonyctes inermiceps*, Bergr.

Ann. Soc. Ent. Belge, l. p. 270 (1906).

Emesa barbara, Butl., nec Lucas, Phil. Trans. Roy. Soc. clxviii., Hemipt. p. 551 (1879).

Described from E. Madagascar.

2 ♂♂, 5 ♀♀, and 1 larva; 2 ♀♀ (*Gulliver*).

This species seems to vary somewhat in depth of colouring, due no doubt to the degree of maturity. The size is also variable and ranges from 17 mm. in the ♂ to 20 mm. in the ♀.

Subfamily STENOPODINÆ.

32. *Sastrapada baerensprungi*, Stål.

Harpagochares baerensprungi, Stål, Ofv. Vet.-Ak. Forh. 1859, p. 381.

Sastrapada baerensprungi, Stål, Kongl. Sv. Vet.-Ak. Handl. xii. no. 1, p. 86 (1874).

Widely distributed over S. Palæarctic, Oriental, Australian, and Ethiopian Regions, including Réunion and Madagascar.

1 ♂ (*Sinclair*).

33. *Oncocephalus sordidus*, Stål.

Öfv. Vet.-Ak. Förh. 1855, p. 44.

Recorded from S. and E. Africa, Seychelles, Madagascar, and Réunion.

4 ♀ ♀, 3 ♂ ♂, and 5 larvæ, August and September.

2 ♀ ♀ (*Sinclair*).

The ten specimens of *O. cancellatus*, Stål, recorded from Rodriguez by Butler, cannot now be found, but it is probable that they would really belong to this species.

Subfamily *REDUVIINÆ*.

34. *Conorhinus rubrofasciatus*, de Geer.

Mém. iii, p. 349, t. 35. fig. 12 (1773).

Recorded from Brazil, W. Indies, India, China, Philippines, Sierra Leone, Seychelles, Madagascar, and Réunion.

1 ♂, September; 1 ♂, 2 ♀ ♀ (*Sinclair*).

The specimen taken by Slater, and recorded by Butler, cannot now be found in the British Museum Collection.

35. *Rhinocoris* ? *laniger*, Butl.

Reduvius laniger, Butl., Ann. & Mag. Nat. Hist. (4) xvii. p. 411 (1876); Phil. Trans. Roy. Soc. clxviii., Hemipt. p. 550, pl. liv. figs. 6 & 6 a (1879).

Harpactor laniger, Leth., Sev. Cat. Hemipt. iii. p. 160 (1896).

The type of Butler's species cannot now be found in the British Museum Collection.

Family Nabidæ.

Subfamily *NABINÆ*.

36. *Nabis* (*Reduviolus*) *capsiformis*, Germ.

Nabis capsiformis, Germ., Silb. Rev. Ent. v. p. 132 (1837).

Reduviolus capsiformis, Reut., Mém. Soc. Ent. Belge, xv. p. 114 (1908).

**Sasirapada nigrolinsata*, Dist., Ann. & Mag. Nat. Hist. (9) vi. p. 159 (1920) [n. syn.].

Cosmopolitan.

4 ♂ ♂, 2 ♀ ♀, and 3 larvæ.

* I have taken this opportunity to synonymise Distant's species from New Caledonia.

Family Anthocoridae.

Division LYCTOCORARIA.

37. *Lasiochilus sladeni*, Dist.

Trans. Linn. Soc. Lond. (2) xvi., Zool. p. 185, pl. xiii. f. 22 (1913).

Described from Seychelles.

4 specimens.

38. *Lasiochilus seychellensis*, Dist.

Trans. Linn. Soc. Lond. (2) xvi., Zool. p. 185, pl. xiii. f. 23 (1913).

Described from Seychelles.

2 specimens.

Family Miridae.

Division CAPSARIA.

39. *Creontiades pallidus*, Rmb.

Phytocoris pallidus, Rmb., Faun. Ent. Andal. p. 159 (1842).

Pantliodes pallidus, Reut., Act. Soc. Sci. Fenn. xxiii. no. 2, p. 238, t. 2. f. 14 (1896).

Creontiades pallidus, Poppins, Act. Soc. Sci. Fenn. xli. no. 8, p. 22 (1912).

* *Megacelum (Creontiades) mimicum*, Dist., Trans. Linn. Soc. Lond. (2) xvi., Zool. p. 175, pl. xiii. fig. 15 (1913) [n. syn.].

Widely distributed over Mediterranean and Ethiopian regions, including Madagascar and Seychelles.

1 ♂, 1 ♀.

40. *Proboscidocoris punctaticollis*, Reut.

Öfv. Finnska Vet. Soc. Forh. xlvii. no. 10, p. 16 (1905).

Recorded from E. Africa, Pemba Is., Madagascar, Réunion, and Comoren.

1 ♀.

Division MACROLOPHARIA.

41. *Engytatus volucer*, Kirk.

Trans. Ent. Soc. Lond. 1902, p. 247.

Described from Réunion.

2 ♂♂, 2 ♀♀, and 2 larvæ.

Kirkaldy described the hemelytra as greyish cinereo-hyaline, but Poppins (Act. Soc. Sci. Fenn. xlv. no. 8, p. 18 (1914)) says that in the type-specimen the tips of the corium

* I have taken this opportunity to synonymise Distant's species from Seychelles,

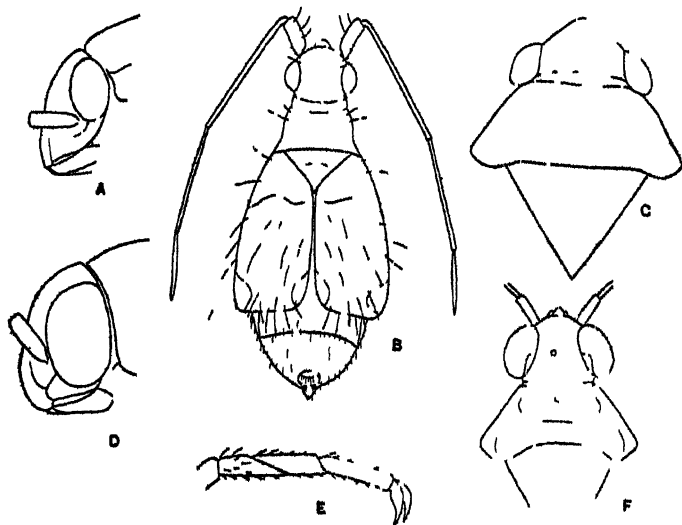
and cuneus are mutilated. In all the specimens from Rodriguez, the extreme outer apex of the corium and the extreme apex of the cuneus are dark.

Division SYSTELLONOTARIA.

42. *Chaetocapsus scotti*, sp. n. (Fig. 3, B.)

♀. Head dark chocolate-brown, very finely granulate, not at all shining, with several long erect bristle-like hairs; vertex and frons strongly convex, clypeus at its apex with a few short pale hairs, moderately strongly prominent, distinctly

Fig. 3.



- A. *Trevesa albidopicta*, sp. n., side view of head; (C). Head and pronotum of same; E. Hind tarsus of same. B. *Chaetocapsus scotti*, sp. n. D. *Campylomma selecta*, sp. n., side view of head. F. *Acanthia subcarinata*, sp. n., head and pronotum.

separated from the frons, the anterior surface of which forms an obtuse angle with it; eyes rather small, widely separated, granulate, with a few short erect hairs, the posterior margins touching the anterior margin of the pronotal collar*; base of the head including eyes a little narrower than the posterior margin of the pronotum; antennæ long, placed slightly below the anterior apices of the eyes, basal joint ochraceous

* In the type-specimen the head is slightly protruding and consequently the eyes do not touch the pronotum.

with the basal half brown, somewhat thickened, covered with pale short depressed hairs and with a few long erect bristles, surpassing apex of head by nearly half its length; remaining joints ochraceous, moderately fine, gradually tapering towards the apex and clothed with fine, short, depressed hairs, the second joint three times as long as the basal one, the third a little more than two-thirds the length of the second, and the fourth two-thirds the length of the third; rostrum long, extending to the base of the abdomen, brown, the basal joint extending to the base of the procoxae. *Pronotum* dark chocolate-brown, dull, very finely granulate, with several long erect bristle-like hairs, especially on the anterior lateral margins; apical collar distinct, rather flattened, disc convex, the calli indistinctly delimited, lateral margins slightly convexly sinuate, the posterior margin widely emarginate and distinctly wider than the anterior margin. *Scutellum* unicolorous with the pronotum, dull, finely granulate with several long erect hairs, the disc concave when seen from the side. *Hemelytra* convex, parchment-like; clavus, corium, and cuneus fused together, membrane absent; moderately shining, sparsely covered with long erect bristle-like hairs, extending about two-thirds the length of the abdomen, apical margin truncate with the angles rounded, costal margin slightly explanate; dark chocolate-brown, the basal third, the basal half of the costal margin, a large spot on the external angle, and a smaller spot on the anal angle whitish; wings absent or rudimentary. *Abdomen* dark brown, shining, covered with short and long hairs, very broad towards the apex, moderately narrowed towards the base. *Legs* covered with short depressed hairs, the upper side of the femora with a row of long bristle-like hairs, the tibiae armed with a few feeble bristle-like spines. *Tarsi* linear, the basal joint short, the second a little longer than the third; claws well developed, arolia absent or piliferous. *Coxae*, trochanters, basal half of middle and hind femora, extreme base of fore femora, tibiae, and tarsi whitish yellow; fore femora and apical half of middle and hind femora chocolate-brown, extreme apices of femora yellowish.

Total length 2.2 mm., width of pronotum anteriorly 0.4 mm., posteriorly 0.54 mm.

1 brachypterous ♀.

I have referred this species to *Chaetocapsus*, although it differs in certain characters from Poppius's description*.

* Acta Soc. Sci. Fenn. liv. no. 3, p. 38 (1914).

The genus was described from a single macropterous ♂ from Togo. The chief differences, excluding those naturally associated with a brachypterous ♀, are that the "fore-body" is "matt" and the hemelytra shining.

Division HETEROTOMARIA.

43. *Cyrtorrhinus parviceps*, Reut.

Revue d'ent. 1890, p. 258.

* *Cylloceps pellicia*, Uhl., Proc. Zool. Soc. Lond. xlviii. p. 711 (1893) [n. syn.].

Recorded from Egypt, E. Africa, Seychelles, and West Indies (St. Vincent).

2 ♂ ♂, 16 ♀ ♀.

Division PHYLARIA.

44. *Sthenarus leucochilus*, Reut.

Öfv. Finska Vet. Soc. Forh. xlvii. no. 22, p. 8 (1905).

Recorded from Seychelles, Réunion, Pemba, Madagascar, and E. Africa.

9 ♂ ♂, 22 ♀ ♀, August and September.

45. *Campylomma selecta*, sp. n. (Fig. 3, D.)

Head yellow, smooth, covered with short pale hairs and long semi-erect black hairs; short and depressed, slightly wider at base (including eyes) than pronotum anteriorly, basal margin of vertex straight, distinctly angular, not rounded; clypeus fairly prominent; eyes granulate; antennæ placed one-third length of eye from the anterior (ventral) margin of the eye; first joint short, scarcely reaching apex of clypeus, yellowish with the base and apex light brown; second joint light brown, gradually thickening towards the apex, about three times longer than the first; third joint mutilated, basal part black, remainder missing; rostrum light yellow, with the apex dark brown, extending to midway between the middle and hind coxæ, basal joint just reaching the anterior margin of the prosternum. *Pronotum* greenish yellow, smooth, covered with short pale hairs and long semi-erect black hairs; lateral margins straight. *Scutellum* with lateral margin somewhat shorter than the basal width, the base exposed and the extreme apex dark brown, otherwise similar to pronotum. *Hemelytra* pale greenish yellow, more or less hyaline; the clavus and corium covered with dark

* I have compared the type-specimen of this West Indian species with that of Reuter's *C. parviceps* and consider them to be synonymous.

hairs, which are somewhat longer and thicker on the costal margin; extreme apex of clavus dark brown, and the apical margin of the embolium narrowly reddish (the embolium is very distinctly delimited except towards its extreme apex); membrane colourless hyaline with veins and two spots near apex of cuneus brownish yellow. Wing-cell with a fairly distinct hamus. *Abdomen* and thorax below pale yellow. *Legs* pale yellow, the last joint of the tarsus brown; hind femora with two black spots above, close together, near the apex and three black spots below, one near the apex and two near the middle; the middle femora also spotted towards the apex; tibiae armed with black spines arising from small black spots; the last joint of tarsus slightly longer than the second, the first short; tarsal pads (arolia) distinct, reaching about the middle of the claws, arising from a blunt basal tooth of the claw and converging towards their apices.

Total length 3 mm., width across base of pronotum 1.3 mm.

1 ♀.

This species seems to agree fairly well with the specific description of *Plagiognathidea grisescens*, Poppius, but it differs in the generic characters.

TREVESSA *, gen. nov.

Very small, oblong-ovate, impunctate, covered with rather long, pale, semi-erect hairs.

Head one-fifth shorter than the width including the eyes, very slightly wider at base than anterior margin of pronotum, very strongly downwardly inclined so that only the basal two-thirds can be seen from above, and the clypeus is nearly at right angles to the plane of the disc of pronotum; eyes granulate, moderately small, with the posterior margins touching the anterior margin of the pronotum; width of vertex between the eyes two-thirds the total width including the eyes; vertex and frons moderately strongly convex, clypeus not at all prominent, basal margin of vertex slightly convexly curved, angular, almost carinate; antennæ placed about one-fifth length of eye from its apex—basal joint short, scarcely reaching the apex of the clypeus, second joint long, a little more than four times the length of the first, remainder missing; rostrum long, extending to base of third apparent

* The British steamer 'Trevesa' foundered in the Indian Ocean on June 4th, 1923, and Captain Forster, the chief engineer, and sixteen of the crew reached Rodriguez on the 26th of June after covering 1200 miles in an open boat. The rest of the crew reached Mauritius on the 29th.

abdominal segment, its basal joint extending to base of prosternal xyphus, the second joint longest, extending to apex of pro-coxæ, the third and fourth joints subequal. *Pronotum* transverse, trapeziform—apical margin slightly concave, no apical stricture, lateral margins straight, rather sharply angular along basal third, disc slightly convex, the calli very indistinctly delimited, not at all prominent, extending to middle of disc; posterior margin strongly emarginate, uncovering the mesoscutum. Prosternal xyphus difficult to see, but not at all convex and apparently margined. *Scutellum* triangular, flat on disc, laterally shorter than width at base. *Hemelytra* well developed, extending well beyond apex of abdomen; the fracture well developed, distinctly sinuate, the corium at apical margin slightly overlapping the base of the cuneus; membrane biarcuate, but outer areole small and the dividing vein (apex of radius) indistinct. Wings large, the wing-cell without a hook-vein (hamus). Femora dark brown, except the bases and extreme apices, not at all spotted, hind femora strongly incrassate; tibia rather feebly armed with a few pale bristle-like spines. Tarsi moderately short, apex of first joint strongly obliquely truncate, so that when viewed from above first joint is much shorter than the second, and when viewed from below basal joint is much longer than the second; viewing from the side and taking the median length, the first is slightly shorter than the second; the second and last joints subequal; tarsal claws well developed, moderately curved, arolia absent.

Genotype, *T. albidopicta*, sp. n.

The position of this genus is doubtful—I have, however, referred it to the Phylinae in spite of certain exceptional characters, such as the absence of a wing-cell hamus. The general facies are those of *Campylomma*, but it differs in the structure of the tarsus, the femoral markings, etc.

46. *Trevesa albidopicta*, sp. n. (Fig. 8, A, C, & E.)

Dark chocolate-brown, covered with pale semi-erect hairs. The basal angles of the pronotum obscurely, the apical half of the scutellum, the base of the hemelytra as far as the apex of the scutellum, the outer apex of the corium above the base of the cuneus, the base and extreme apex of the cuneus whitish. Membrane pale fuscous, arcolar veins whitish. Antennæ ochraceous, the apical half of the second joint brown. Rostrum ochraceous with the tip blackish. Femora chocolate-brown with the bases broadly whitish.

and the apices narrowly yellowish. Tibiæ pale, the posterior tibiæ with the base whitish and the middle brown. Abdomen below shining brown.

Total length, including membrane, 2 mm.; width 0·7 mm.

2 ♀ ♀, September.

Family Veliidæ.

47. *Rhagovelia nigricans*, Burm.

Velia nigricans, Burm., Handb. xi. p. 213 (1835).

Velia infernalis, Bull., Ann. & Mag. Nat. Hist. (4) xvii. p. 411 (1876);

Phil. Trans. Roy. Soc. clxviii. Hemipt. p. 551, pl. liv. fig. 5 (1879).

Rhagovelia nigricans, Kirk., Entomologist, xxxiv. p. 310 (1901).

Widely distributed over Ethiopian and Oriental Regions, including Syria and Seychelles.

3 ♂ ♂, 5 ♀ ♀, apterous; 1 ♂, 2 ♀ ♀, winged; and 1 larva. September.

4 ♂ ♂, 5 ♀ ♀, apterous (*Gulliver*), including Butler's type of *V. infernalis*.

Family Gerridæ.

48. *Limnogonus dolosa*, Bergr.

Rev. d'Ent. xii. p. 203 (1893).

Described from Seychelles.

5 ♀ ♀ and 2 ♂ ♂ apterous, 1 ♀ winged, and 1 larva.

The males are distinctly smaller than the females, measuring only 6·3 mm. (♀ ♀, 8–9 mm.).

Family Acanthiidæ.

49. *Acanthia (Saldula) subcarinata*, sp. n. (Fig. 3, F.)

♂. Oval, rather elongate. *Head* black with a short golden-yellow pubescence and a few long bristles above, and a silvery pubescence below; clypeus and the transverse carinæ above its base golden yellow; labrum (except the base and apex, which are brown), the apices of the loræ, a small round spot on each side between the ocelli and the eyes, and the sinuate inner posterior margin of the eyes narrowly, pale yellowish; eyes large with a few short erect hairs, ocelli about twice as far from the margin of the eye as from one another; rostrum shining brown, extending to the base of the hind coxæ; antennæ moderately thin, the basal joint short, shining brownish ochraceous, somewhat thickened, slightly pubescent with a few black bristles; second joint unicolorous with the first, rather darker towards

its apex, clothed with black hairs, slightly more than twice as long as the first; third and fourth black clothed with longer hairs, the fourth subequal with the first, the third a little longer than the first. *Pronotum* black, moderately shining, thickly covered with short golden hairs, apical stricture distinct, posterior margin broadly and moderately deeply emarginate, nearly three times broader than the length of the pronotum in the middle, anterior margin nearly once and a half broader than the length in the middle, distinctly narrower than the base of the head including eyes; callus distinctly convex, extending a little beyond the middle of the pronotum, and approaching very closely to the lateral margin on each side, its anterior margin deeply foveolate in the middle, but without a longitudinal sulcation behind the fovea; lateral margins straight, very little explanate, and very feebly carinate. *Sternum* shining black, covered laterally with short whitish hairs; apical margin of pro-acetabula broadly whitish. *Scutellum* shining black, thickly covered with short golden and dark brown hairs, the latter mainly on the apical half; lateral margins about as long as width at base. *Hemelytra* mainly dull, slightly shining on the costal margin, covered with a short dark brownish-black pubescence, the basal two-thirds of the clavus and the extreme base of the corium also with short golden hairs; colour brownish grey with the basal two-thirds of the clavus, the apex of the costal margin, and a large spot on the margin level with the apex of the clavus, black; the rest of the costal margin except towards the base, which is brownish, is dull whitish yellow; a spot on the apex of the clavus and various obscure markings on the corium greyish; membrane extending well beyond the apex of the abdomen, the four cells whitish, each with a fuscous spot, and the first, second, and third also fuscous towards the base; the marginal area fuscous, except the extreme outer apical edge and the outer basal edge; the first or interior cell reaching the apex of the second and extending slightly above its base; veins fuscous. Wings well developed. *Abdomen* below shining blackish brown, covered laterally with short whitish hairs, the apical margins of the first five apparent segments narrowly ochraceous, the apical third of the sixth (covering the genitalia) white. Trochanters yellowish white; femora brown, with the basal third and the apex narrowly yellowish white; fore tibiae whitish, with the base, a median annulation, and the extreme apex brown; middle and hind tibiae whitish tinged with brown on the outside, the base of the hind tibiae brown;

spines dark brown; tarsi with the basal and apical joints brownish. Total length 3.3 mm., basal width of pronotum 1.2 mm.

1 ♀ (on mud).

This species is readily distinguished by the feebly explanate and obsoletely carinate lateral margins of the pronotum. It resembles *opacula*, Zett., in shape, and *pallipes*, F., in the pilosity of the hemelytra; there are, however, much fewer golden hairs towards the base of the corium.

Family Corixidæ.

50. *Micronecta felix*, Butl. (Fig. 4, B.)

Sigara felix, Butler, Ann. & Mag. Nat. Hist. (4) xvii. p. 412 (1876); Phil. Trans. Roy. Soc. clxviii., Hemiptera, p. 551, pl. liv. figs. 8 & 8 a (1879).

Redescription:—

♂. *Head* one and a half times as long (seen from above) as the pronotum in the middle, dark piceous brown, except the disc of the vertex which is whitish; obscurely and irregularly rugose; width including the eyes distinctly greater than the width of the pronotum. *Pronotum* sepia-brown, lateral margins very short, the outer posterior angle of the eye reaching to the base of the hemelytra; strongly transversely wrinkled, five times as wide as long in the middle. *Scutellum* subequilateral, a little shorter than the pronotum, smooth, shining, dark brown. *Hemelytra* much broader in the middle than at the base, moderately convex, dark shining sepia-brown, immaculate, with the costal margin broadly whitish; obsoletely punctate, regularly covered with short, pale, depressed, bristle-like hairs; subcostal furrow short, extending about one-quarter the length of the hemelytra. *Legs* fuscous, the basal half of the intermediate femur and the hind femur ochraceous. Intermediate femur a little shorter than the tibia, tarsus, and tarsal claws together; tibia two-thirds the length of the tarsus, tarsal claws a little shorter than the tibia. Abdomen below grey. Total length 2.3 mm., width across pronotum 0.89 mm., width across middle of hemelytra 1.3 mm.

6 specimens (*Gulliver*). Type is a ♂.

This species appears to belong to the *solitaria*, Horv., group.

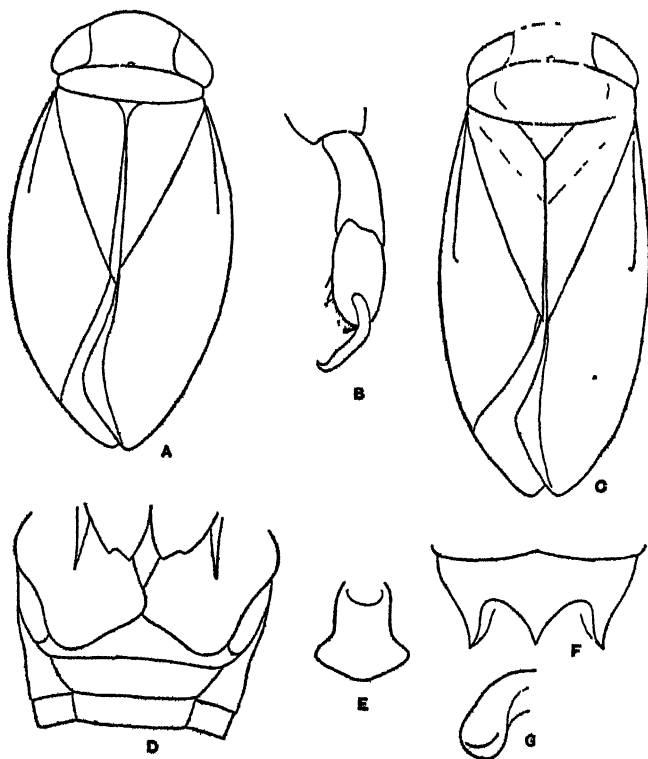
51. *Micronecta sulcata*, Sign.? (Fig. 4, C.)

Signoret, Ann. Soc. Ent. France, (3) viii. p. 971 (1861); Butler, Phil. Trans. Roy. Soc. clxviii., Hemiptera, p. 551 (1879).

The single ♀ specimen collected by Gulliver agrees more or less with Signoret's meagre description.

The *head* is about four-fifths the length of the pronotum in the middle, moderately arched between the eyes, smooth pale shining yellow, the clypeus brown and a trace of a narrow median brown line towards the apex of the frons,

Fig. 4.



A. *Micronecta dubia*, sp. n. B. *Micronecta felix*, Butl., anterior tibia and tarsus. C. *Micronecta sulcata*, Sign.? D. *Cnada thomasseti*, sp. n., ventral view of opercula; F. Seventh apparent tergite of same; E. and G. End and lateral view respectively of uncus of same.

but not visible on the vertex. *Pronotum* with the sides not quite half the length of the posterior margin of the eye; three times as wide as long in the middle, shining greyish yellow with the disc largely brown. *Scutellum* dark brown on the apical half and ochraceous on the basal half, sides

shorter than the width at the base. *Hemelytra* yellowish grey tinged with brown, shining, obscurely punctate, and clothed with short depressed bristle-like hairs; the costal margin towards the base, the anterior margin of the clavus broadly, and the inner margin narrowly, pale yellow; hemelytra nearly two and a half times the length of the subcostal furrow; costal margins subparallel. *Abdomen* below and legs pale yellow; intermediate femur distinctly shorter than the tibia, tarsus, and tarsal claws together; tibia a little more than half the length of the tarsus; tarsal claws long, slightly longer than the tibia.

Total length 3.3 mm., width across pronotum 1.2 mm.

1 ♀ (*Gulliver*).

This species appears to belong to the *pharaonum*, Horv., group.

Originally described from Madagascar.

52. *Micronecta dubia*, sp. n. (Fig. 4, A.)

Sigara scutellaris, Butl., nec Stål, Phil. Trans. Roy. Soc. clxviii., Hemiptera, p. 551 (1879).

♀. *Head* a little more than twice the length of the pronotum in the middle, strongly arched between the eyes, pale olivaceous brown above, rather paler below, obscurely rugose; clypeus rather darker. *Pronotum* with the sides very short, the posterior margin of the eyes four and a half times as long as the lateral margin of the pronotum; pale olivaceous brown, obscurely transversely wrinkled, five times as wide as long in the middle. *Scutellum* unicolorous with pronotum, small, three-quarters the length of the pronotum in the middle. *Hemelytra* strongly convex, unicolorous with pronotum, but somewhat paler; the membrane and the apical disc of the corium darker, the latter dark area extending more narrowly up the middle of the corium; the inner edge of the costal marginal area, the base of the claval suture, and two obscure spots on the clavus also darker; more or less shining, and very obscurely punctate, regularly covered with short depressed hairs; subcostal furrow short, little more than one-quarter the length of the hemelytra, costal margins distinctly convex, the hemelytra wider in the middle than at the base, but not so much so as in *M. felix*, Butl. *Abdomen* below olivaceous grey, covered with short pale hairs. *Legs* yellow, the intermediate femur a little longer than the tibia, tarsus, and tarsal claws together; tibia two-thirds the length of the tarsus; tarsal claws subequal with tibia.

Total length 2.9 mm., width across pronotum 1 mm., width across middle of elytra 1.5 mm.

2 ♀ ♀ (*Gulliver*).

This species appears to belong to the *latiuscula*, Horv., group.

Suborder HOMOPTERA.

Family Cicadidæ.

Cicada thomasseti, sp. n. (Fig. 4, D, E, F, & G.)

♂. *Head* ochraceous with a black transverse band between the eyes, extending backwards between the ocelli to the posterior margin, and three small black spots on each side between the ocelli and the base of the eyes. *Frons* with a central longitudinal black stripe, and laterally with several black horizontal striæ. Length of head from middle of posterior margin to dorsal apex of frons 3.5 mm.; width, including eyes, 10 mm. *Antennæ* black, merging into dark fuscous towards the apical joints. *Rostrum* extending to the posterior coxæ, pale ochraceous, with the apex black. *Pronotum* ochraceous with two narrow subparallel black stripes down the centre, and two crescent-shaped black marks on either side; oblique sulci dark brown. *Lateral margins* pale yellow margined interiorly with dark brown, strongly carinate but scarcely dilated, armed at the anterior angles behind the eyes with a minute tooth; posterior margin transversely wrinkled—length in middle 4 mm., width anteriorly 8.5 mm., posteriorly 11.5 mm. *Mesonotum* ochraceous, with four obconical dark brown spots along the anterior margin, the outer pair extending almost to the posterior margin and somewhat reticulately cut up by invading ochraceous bands, the inner pair extending a little beyond the middle; above and bordering on the cruciform elevation are three small black spots—one central, the others directly below each of the two obconical marks; the area above these three spots and the middle of the cruciform elevation is brown in colour, and forms part of a rich brown stripe, which extends across the metanotum between the tympanal coverings to the abdomen; width anteriorly 10 mm. *Tympanal coverings* strongly developed, pale ochraceous, completely covering the tympanal orifices. *Opercula* pale ochraceous, short, rounded, not extending beyond the metasternum, the interior posterior angles overlapping,

the lateral margins concavely sinuate (fig. 4, D). *Abdomen* ochraceous with the basal half of the first apparent tergite rich brown, the tergites laterally and the middle of the first tergite blackish brown; the sixth apparent tergite with a black patch on each side towards the base; the seventh apparent tergite (covering the anal style) deeply cut out on each side to form a dorsal and two lateral teeth (fig. 4, F). *Uncus* black, broad, strongly inwardly curved (fig. 4, E & G). *Tegmina* and wings vitreous, immaculate, the veins ochraceous, and the basal membranes greyish ochraceous. Width of tegmen at widest part 12 mm., length 40 mm.

Total length of body 27 mm., breadth across tympanal coverings 13 mm., expanse of tegmina 86 mm.

♀. Similar to male, but smaller—length 23 mm.

7 ♂♂, 1 ♀.

In some of the specimens the colour-markings are much less distinct, the pronotum being entirely ochraceous, except for the two subparallel median black stripes.

Larvæ collected by Gulliver in 1874 probably belong to this species.

XLIV.—*On a Pelagic Phase of Arenicola marina and of Eteone arctica.* By A. MEEK and B. STORROW, Dove Marine Laboratory, Cullercoats.

[Plate VII.]

ALTHOUGH the common lugworm, *Arenicola marina*, is abundant in sandy beaches all round the coast, and is gathered by digging for bait, its method of development is not known. It was therefore with a great deal of expectancy that we observed it in a pelagic condition in the harbour at Beadnell on the Northumberland coast. The 'Evadne' arrived at Beadnell on 20th March, 1924, and on the 21st we observed two polychæts near the surface, drifting in the current, but both maintaining their position by active contractions and wriggling movements. Examples of each were easily procured with no better an instrument than a broom, and we were surprised to find that one was *Arenicola marina* and, afterwards, that the other was *Eteone arctica*, a determination which was kindly confirmed by Professor M'Intosh.

A fact which struck us forcibly at the time was that the pelagic state was observed only during the beginning of the ebb, and at a period of full moon.

Next day both were seen again at the beginning of the ebb, but both were scarce. Thereafter *Arenicola* was not seen again at the surface, but *Eteone* was observed as follows:—23rd one, 24th and 25th none, 26th one. No specimens were seen after the last date, and we left Beadnell on 31st March. Returning on 25th April we were told by the engineer of the 'Evadne,' Mark Anderson, that specimens of *Eteone* had been observed on 21st April at half-ebb and just after full moon, and he submitted them to us. On the 25th and the two following days further examples of pelagic *Eteone* were preserved. We left Beadnell early on 28th April.

The temperature of the sea at the time was low, and the water became colder with the neap tides, *e. g.* March 24, 4.5° C.; March 25, 4.3° C.; March 26, 4.1° C.; March 29, 3.75° C.; March 31, 5° C.

Live examples of *Eteone*, and all gave evidence of being mature, were kept in a bottle of sea-water for a couple of days, and spawned, yielding a large number of eggs without an egg-capsule being formed. Similarly, *Arenicola* was kept in a bucket for a day, but yielded no eggs.

All the examples of *Arenicola* were more or less completely invested in a clear jelly-like capsule. On our return sections were made from different parts of the body of one example by the Laboratory Steward of the Zoological Department, D. G. Geddes, and another was dissected. Both indicated, contrary to expectations, a spent condition. We feel, however, that the pelagic phase we have observed, by a lucky association of time and place, is connected with spawning, but that spawning had already taken place. It is also practically certain that the eggs are launched freely into the water and that an egg-capsule is not formed.

A few remarks may be added with regard to the capsule, figures illustrating which are given. It is secreted by the ectoderm of the body-region, not the tail. It is clear and gelatinous, and in section exhibits a homogeneous or alveolar structure (Pl. VII. fig. 1). In the case of the worm cut into sections two layers are apparent connected by threads of greater density (Pl. VII. fig. 2). It is probable that these point to two successive visits to the surface, but above the gills it is only one-layered (Pl. VII. fig. 3). It stains

similarly to the ectoderm, holding on to the hæmatoxylin in contrast to the deeper structures which exhibit a distinct but varying affinity for eosin. The layers are directed outside the gills and the chætæ.

The œsophagus seems to contribute its quota, for its cells are similarly active, and its cavity is filled by a similar secretion. But the most remarkable feature with relation to the whole alimentary canal is the absence of sand.

Eteone arctica occurs in the sand in Beadnell Bay, Cullercoats Bay, and at the mouth of the Tyne. Those taken at Beadnell were divided easily into two groups, one being at least twice the length of the other. The larger specimens were all ripe females, and the smaller were males full of sperms. *Eteone* forms no gelatinous capsule, but the ectoderm stains as in *Arenicola*, and exterior to the regions about the feet there is, in section, a similar alveolar exudation to that found in *Arenicola*. *Eteone* was much more active, and the wriggling movements were more violent and rapid. When movement ceased both worms sank slowly, but whilst *Eteone* sank in a horizontal position with the body thrown into two or three curves, *Arenicola* sank inclined obliquely, the body straight, and the anterior portion upwards. It is probable the capsule in *Arenicola* acts as a float.

EXPLANATION OF PLATE VII.

Fig. 1. Transverse section of capsule of *Arenicola*.

Fig. 2. The two layers of the capsule of *Arenicola*.

Fig. 3. The two layers of the capsule of *Arenicola* becoming merged in one layer outside the gills.

XLV.—A new Subspecies of *Nyctinomus australis*.

By OLDFIELD THOMAS.

THE British Museum owes to Prof. Wood Jones three examples of the fine free-tailed bat *Nyctinomus australis* from the neighbourhood of Adelaide—two males and a female. These are of interest as showing how slight are the differences, either in the development of the gular pouch or in the skull and dentition, between the sexes, there being almost no difference at all in any of these respects. In most other

species the skull of the male is larger and with heavier canines than that of the female, and the gular sac is often much more developed.

In addition, the colour-characters recorded by Dobson as distinguishing the sexes prove not to be sexual at all, but are individual variations of but little importance. *N. albidus*, Leche, based primarily on these asserted sexual characters, is, no doubt, a synonym of true *N. australis*.

With the help of these Adelaide specimens and those already in the National Museum, including the type, we see that the species is normally of a dark brown colour, with the bases of the hairs, both above and below, either white or, at least, markedly lighter than their ends; and there is always a strongly marked white or whitish band along the lateral wing-membrane below close to the sides of the body, often extending on to the latter.

In contrast with the above, a further example, from the interior more desert part of South Australia, which we also owe to Prof. Wood Jones, appears to represent a race sufficiently distinct to deserve subspecific separation, and I would propose to call it

Nyctinomus australis atratus, subsp. n.

Fur above and below wholly black, the hairs, in marked distinction from those of *australis*, black to their bases, or, if there is any difference, the tips may even be faintly browner and paler. Lateral wing-membrane without any trace of the whitish line along the edge of the body below, the hairs of this part being equally black with the rest. Indeed, the only light-coloured hairs on the whole animal are a few at the back of the femora below.

Dimensions of the type :—

Forearm 59 mm.

Head and body 91; tail 35; ear 25; third finger, metacarpal 59.

Skull: greatest length 24.3; front of canine to back of m^3 9.2.

Hab. Ooldea, South Australia.

Type. Adult male. B.M. no. 24.8.4.8. Presented by Professor F. Wood Jones. One specimen.

XLVI.—*New or little-known Tipulidæ (Diptera).*—XXV.
Palæarctic Species. By CHARLES P. ALEXANDER, Ph.D.,
 F.E.S., Massachusetts Agricultural College, Amherst,
 Massachusetts, U.S.A.

THE present paper deals with species of the genus *Tipula* from various parts of Japan, chiefly from the mountains of Hokkaido and Honshiu. One species was collected by Mons. de Lezey and is contained in the collection of the Paris Museum. The other species were kindly sent to me by my friends, Messrs. Esaki, Kuwayama, and Machida, to whom I am vastly indebted for the privilege of retaining the types.

Tipula manca, sp. n.

General coloration yellow; antennæ yellow; head grey posteriorly; mesonotal præscutum with three pale brown stripes; pleura whitish-pruinose; wings grey with a subhyaline cross-band beyond the cord; tip of vein R_2 atrophied; abdomen yellow with a terminal black ring; male hypopygium with the ninth tergite notched; eighth sternite with a median pencil of long yellow setæ.

Male.—Length 14 mm.; wing 15.5 mm.

Frontal prolongation of the head obscure yellow; nasus elongate; palpi pale brownish yellow. Antennæ short, light yellow, only the terminal segments a little darker; verticils conspicuous, black. Vertical tubercle obscure yellow, the remainder of the vertex and occiput grey, the smooth median area with a narrow, light brown vitta.

Mesonotal præscutum yellow with three pale brown stripes, the broad median stripe split by a line of the ground-colour; remainder of the mesonotum obscure yellow, the scutal lobes a little darkened. Pleura whitish-pruinose, the dorso-pleural region slightly more yellowish. Halteres brown, the base of the stem yellow. Legs with the coxæ and trochanters light yellow; femora yellow, the tips faintly infuscated; remainder of the legs obscure yellow, the terminal tarsal segments darkened. Wings grey, the stigma dark brown; a seam at $r-m$ and the wing-apex in cells R_2 , R_3 , and R_5 paler brown; a conspicuous subhyaline cross-band beyond the stigma, occupying the basal two-fifths of cell R_2 and about the basal third of cells R_3 and R_5 ; cell 1st M_2 largely subhyaline; veins pale brown. Venation: R_2 almost perpendicular at origin, the distal section from

slightly beyond r completely atrophied; deflection of R_{4+5} and $r-m$ subequal; cell 1st M_2 rather small, pentagonal, narrowed distally; petiole of cell M_1 a little longer than m ; basal deflection of Cu_1 at about one-fourth the length of the cell.

Abdomen brownish yellow, the tergites with a very faint, darker brown, median stripe; segments 7 and 8 and tergite 9 black, the caudal margins of the segments conspicuously yellow. Male hypopygium compressed, the sclerites fused basally into a ring. Ninth tergite with a deep V-shaped notch. Eighth sternite with a dense nearly median pencil of long yellow bristles.

Hab. Japan (Honshiu).

Holotype, ♂, Kofu, Kai-no-kuni, 1906 (*L. Drouart de Lezey*).

Paratopotype, sex?

Type in the collection of the Paris Museum.

Tipula plagiotoma, sp. n.

General coloration buffy, the præscutum with four pale stripes, the intermediate pair reddish brown, the laterals darker brown; wings greyish yellow, the base and costal region clearer yellow; a conspicuous whitish obliterative band beyond the cord; tip of vein R_2 atrophied; male hypopygium with the eighth sternite densely tufted with long yellow setæ.

Male.—Length 16 mm.; wing 15.5 mm.

Frontal prolongation of head buffy, the nasus elongate; palpi pale brown, the terminal segments darker. Antennæ relatively short; basal segments obscure yellow, the terminal segments passing into darker; basal enlargements of the individual segments a very little darker. Head light grey, the vertical tubercle more ochreous; vertex with a conspicuous capillary dark brown median vitta.

Mesonotal præscutum buffy with four pale stripes, the intermediate pair barely separated from one another by a capillary pale line, reddish brown, lateral stripes conspicuously darker than the intermediate stripes; remainder of mesonotum yellowish buffy, the scutellum and postnotum with long erect setæ. Pleura buffy, more greyish on the sternopleurite. Halteres pale, the knobs infuscated. Legs with the coxæ pale buffy, with long erect setæ; trochanters yellow; femora yellow, the tips rather narrowly infuscated; tibiæ brownish yellow, the tips slightly darkened; tarsi brownish black. Wings greyish yellow, the base, cells C

and *Sc*, and a seam behind vein *Cu* conspicuously yellow; stigma conspicuous, brown; a seam on the anterior cord and the entire wing-apex paler brown; a broad whitish cross-band extending from the costal margin obliquely basad and caudad to cell 1st M_2 , this including the broad bases of cells R_2 , R_3 , R_4 , and about all of cell 1st M_2 ; a small obliterative area before the stigma and across the proximal end of cell 1st M_2 ; veins dark brown, more yellowish in the flavous areas. Venation: tip of vein R_2 atrophied shortly beyond r ; petiole of cell M_1 about two-thirds longer than m ; cell 1st M_2 relatively small, long, narrowed distally; cell 2nd A relatively narrow.

Abdominal tergites brownish yellow, the basal segments clearer yellow, especially on the glabrous basal annulet; segments 7 to 9 black, the caudal and lateral margins of the segments narrowly obscure yellow; lateral margins of the tergites indistinctly buffy grey, narrowly lined internally by a dusky line; sternites generally similar to the tergites. Male hypopygium relatively large. Ninth tergite with a narrow U-shaped median notch, the lateral lobes thus formed narrow, gently divergent, the apices flattened and gently obtuse. Basistyle distinct, more or less clearly delimited from the sternite, the outer margin produced caudad into a low tubercle, the ventral caudal angle with a tuft of yellow setæ. Ninth sternite with a profound V-shaped notch. Eighth sternite with a dense brush of long yellow setæ on the median line, these directed caudad.

Hab. Japan (Hokkaido).

Holotype, ♂, Sapporo, Ishikari-no-kuni, August 10, 1923 (S. Kuwayama).

Tipulis futilis, sp. n.

General coloration grey; antennæ dark brown, the basal three segments light yellow; wings brown, variegated with whitish subhyaline, this including an almost complete cross-band beyond the cord; tip of R_2 atrophied; abdomen obscure yellow, the terminal segments and a dorso-median vitta dark brown.

Male.—Length 13 mm.; wing 14.2 mm.

Frontal prolongation of the head grey; palpi with the basal segments grey, the terminal segments brown. Antennæ moderately elongate, the scape and first flagellar segment light yellow; remainder of the flagellum dark brown, the segments with a slight basal swelling. Head grey.

Mesonotal præscutum light grey, with three darker

brownish-grey stripes; scutum light grey, the lobes with darker grey centres; remainder of the mesonotum grey. Pleura light grey. Halteres light brown, the knobs a little darker. Legs with the coxae light grey; trochanters obscure yellow; femora obscure yellow, passing into brown at the tips; remainder of the legs dark brown. Wings brown, variegated with whitish subhyaline; base and subcostal cell yellowish; stigma darker brown; the whitish areas are distributed as follows: in the bases of cells *R* and *M*; beyond the origin of *Rs* in cells *R* and 1st *R*₁; at two-thirds the length of cell *M*; near mid-length of cell 1st *A*; at the outer end of cell *Cu*, passing slightly into cell 1st *A*; a conspicuous, almost complete cross-band beyond the stigma and cord, extending from the base of cell *R*₂ where it is narrow, across the bases of cells *R*₃ and *R*₅, including almost all of cell 1st *M*₂ and about the basal two-thirds of cell *M*₄. Venation: apex of vein *R*₂ entirely atrophied, there being two or three macrotrichiae on the spur of the distal section; *m* a little shorter than the petiole of cell *M*₁; *m-cu* punctiform.

Abdomen with the basal tergite grey; remaining segments obscure yellow; a nearly continuous dorso-median brown stripe; hypopygium and segments 7 and 8 dark brown. Male hypopygium moderately incrassated, the tergite and basistyles entirely separated from the sternite. Ninth tergite with a large, circular, median notch. Outer dististyle broadened distally. Eighth sternite unarmed.

Hab. Japan (Honshiu).

Holotype, ♂, Nakano, Tokyo, April 30, 1922 (*T. Esaki*).

Paratype, ♂, Komaba, Tokyo, April 28, 1922 (*J. Machida*); ♂, Mt. Minomo, Settsu-no-kuni, May 1, 1923 (*T. Esaki*).

Tipula superciliosa, sp. n.

General coloration yellowish grey, the præscutum with four brown stripes; pleura ashy grey; halteres yellow; wings strongly tinged with brownish yellow, cell *Sc* entirely dark brown; tip of vein *R*₂ semi-atrophied; *m-cu* placed beyond mid-length of cell 1st *M*₂; base of abdomen yellow, the apex black.

Male.—Length about 11 mm.; wing 14 mm.

Frontal prolongation of head grey dorsally, brown ventrally, with a blackish lateral line; dorsal surface with yellow setae; nasus short and stout; palpi black. Antennae rather long, if bent backward extending to slightly beyond the base of abdomen; scape and base of first flagellar

segment yellowish brown; remainder of flagellum black, the segments moderately incised. Head yellowish grey with a barely indicated capillary median vitta.

Mesonotal præscutum yellowish grey with four brown stripes; intermediate pair long and narrow, vaguely divided anteriorly by a grey line, becoming more approximated behind and separated by a capillary line of the ground-colour; lateral stripes narrow and only faintly indicated; pseudosutural foveæ small and inconspicuous; scutum grey, the lobes more yellowish grey, with two ill-defined darker brown spots on each; scutellum grey with a vague capillary brown vitta; mediotergite of postnotum clear ashy grey, the caudal margin darker. Pleura clear ashy grey, the dorso-pleural membrane brownish yellow. Halteres yellow. Legs with the coxæ grey, their apices yellowish; trochanters obscure yellow; femora obscure yellow basally, passing into brown, the tips blackened; tibiæ brown, the tips blackened; tarsi black. Wings strongly tinged with brownish yellow; cell *Sc* entirely dark brown; stigma small, brown; a tiny brown spot at origin of *Rs*; pale brown seams along vein *Cu* and its branches and on the anterior cord; oblitative areas before and beyond stigma and across the inner end of cell 1st M_2 ; veins brownish black. Venation: *Sc*₂ ending before the fork of *Rs*; tip of vein *R*₂ subatrophied or semioobsolete; *R*₃ straight; *m* about one-half the petiole of cell M_1 ; *m-cu* present, placed beyond mid-length of cell 1st M_2 .

Abdomen with the basal segment yellow, a little infuscated laterally; second segment conspicuously yellow; remaining segments gradually passing into brown, on the sixth tergite becoming black medially, this colour increasing in amount on the succeeding segments, the eighth segment and ninth tergite being entirely black. Male hypopygium moderately large, the tergite, sternite, and basistyle all distinct. Ninth tergite extensive, the caudal margin nearly straight across with a tiny median notch, each lateral angle produced into a small acute tooth. Outer dististyle cylindrical.

Hab. Japan (Hokkaido).

Holotype, ♂, Jozankei, Ishikari-no-kuni, altitude 1000 feet, August 16, 1923 (*T. Esaki*).

Tipula hylæa, sp. n.

General coloration light grey, the præscutum with four narrow brown stripes; halteres yellow, the knobs dark brown; wings whitish subhyaline, the base and cell *Sc*

yellow: cell *C* largely brown; brown cross-bands on the wing-disk.

Female.—Length, excluding ovipositor, about 8 mm.; wing 11.8 mm.

Frontal prolongation of head, including nasus, light grey; palpi dark brown. Antennæ relatively short, if bent backward not attaining the wing-root, brown throughout, the basal segment a little pruinose. Head light grey.

Pronotum grey, a little darker medially. Mesonotal præscutum light grey with four narrow brown stripes, the intermediate pair strongly narrowed behind, separated by a stripe of the ground-colour that is still further split by a capillary dark vitta; scutum grey, each lobe with two brown spots, the posterior mesal one larger, triangular in outline; scutellum and postnotum grey. Pleura clear grey, the dorso-pleural membrane yellow. Halteres yellow, the knobs dark brown. Legs with the coxæ light grey; trochanters obscure yellow; remainder of legs black, the femoral bases rather narrowly obscure yellow. Wings whitish subhyaline, the base and cell *Sc* light yellow; cell *C* brown except a narrow area near the humeral cross-vein; stigma oval, dark brown; a small brown area at origin of *Rs*; another along the cord, completely traversing the wing; wing-apex broadly suffused, including all of cell *M*₁; paler grey clouds in apex of cell 1st *A*; another including all of cell 2nd *A* except the base, passing into the base of cell 1st *A*; a conspicuous cloud crosses cells *R* and *M* before the origin of *Rs*; a brown seam behind vein *Cu*; veins dark brown, yellow in the flavous areas. Venation: *R*₁ long, about one-third longer than *R*₂₊₃; *r* joining *R*₂ some distance beyond its base; tip of vein *R*₂ semi-atrophied; petiole of cell *M*₁ at least three times *m*; *m-cu* elongate, placed before mid-length of cell 1st *M*₂.

Abdomen dark brown, the basal tergite grey-pruinose, the second segment a little reddish laterally at base; ovipositor broken.

Hab. Japan (Honsiu).

Holotype, ♀, Hinoemata, Iwashiro-no-kuni, altitude 8280–8235 feet, July 24, 1928 (*T. Esaki*).

The wing-pattern of this species suggests *Tipula shomio*, Alexander, and *T. taikun*, Alexander.

Tipula phæopasta, sp. n.

Closely allied to *Tipula autumnæ*, Alexander; antennæ longer, the flagellum black; femoral tips darkened; wings

with cell 1st M_2 very small; $m-cu$ longer than m ; ninth tergite of male hypopygium having the apices of the lobes terminating in short black spines.

Male.—Length about 11 mm.; wing 13 mm.

Frontal prolongation of head dark brown, including the nasus; palpi dark brown. Antennæ longer than in *T. autumnæ*, the scapal segments obscure brownish yellow; flagellum uniformly black, the terminal pedicel of each segment fully twice as long as the basal enlargement. Head dull grey, the vertex with a capillary dark line.

Mesonotal præscutum dull grey with three brown stripes, the median stripe cuneiform, almost obliterated in front, the margius and a capillary median vitta dark brown; lateral stripes very narrow and subobsolete, grey; interspaces with conspicuous brown setigerous punctures as in this group of species; scutum grey, each lobe with two brown marks, the mesal one elongate-triangular; a median brown stripe extending the length of the scutum, scutellum, and postnotum, broadest on the scutellum, narrowed and becoming obsolete at mid-length of the postnotum. Pleura dark grey, the sternopleurite still darker grey; dorso-pleural membrane obscure yellow. Halteres obscure yellow, the knobs dark brown. Legs with the coxæ pale, sparsely pruinose; trochanters yellow; femora brown, the bases paler, the colour darkening to the tips; tibiæ brown, the tips dark brown; tarsi brownish black. Wings with a greyish tinge, the base more yellow; cells *C* and *Sc* brownish yellow; stigma elongate, pale brown; outer margins of cells R_2 and R_3 slightly darkened; vein *Cu* margined with brown in cell M ; veins dark brown, very indistinctly seamed with darker; oblitative areas before the stigma and crossing cell 1st M_2 . Venation: *Sc* ending beyond mid-length of R_3 ; tip of R_2 obsolete; cell R_2 small, as in this group of species; cell 1st M_2 very small, pentagonal; m shorter than $m-cu$; petiole of cell M_1 a little longer than m and less than one-fourth the length of the cell; $m-cu$ elongate, before mid-length of cell 1st M_2 .

Abdomen yellow, the tergites narrowly trivittate with dark brown; hypopygium pale. Ninth tergite of male hypopygium large, with a broad V-shaped notch, the caudal margin narrowly chitinized; base of the notch with an acute chitinized tooth, the apices of the lobes terminating in subequal black spines.

Hab. Japan (Honshin).

Holotype, ♂, Osaka, June 27, 1922 (*T. Esaki*).

Tipula holoteles, sp. n.

Vertex orange, with a dark brown median line; mesonotal præscutum brown with four dark brown stripes; scutellum and postnotum with a median dark vitta; apices of halteres yellow; wings narrow, subhyaline, conspicuously variegated with brown and yellow; abdomen yellow to orange, trivittate with brown.

Male.—Length about 15 mm.; wing 23.5 mm.

Female.—Length about 16 mm.; wing 25.5 mm.

Frontal prolongation of head, including the nasus and palpi, dark brown. Antennæ short, if bent backward not attaining the wing-root; basal segment of scape yellow; second segment brown; flagellum black. Front and anterior part of vertex pale yellow; remainder of vertex orange, with a conspicuous longitudinal dark brown median stripe.

Pronotum pale brown. Mesonotal præscutum rich brown, the lateral margins more greenish grey, with four conspicuous dark brown stripes; pseudosutural foveæ small, dark brown; scutum brown, each lobe with two conspicuous dark brown areas; scutellum and postnotum testaceous, each with a conspicuous median brown vitta. Mesonotal interspaces with conspicuous erect pale setæ. Pleura yellow, the anepisternum, sternopleurite, and meron variegated with greyish. Halteres pale brown, the knobs with conspicuous yellow apices and darker bases. Legs with the coxæ and trochanters yellow, darker in the female; femora brownish yellow, the tips conspicuously blackened; tibiæ light brown, gradually passing into darker brown; tarsi dark brown. Wings long and narrow, with a conspicuous petiole, subhyaline, the costal region more yellowish; stigma brown; wing-membrane with conspicuous pale brown clouds, including the bases of cells *R* and *M*, origin of *Rs*, along the anterior cord and outer end of cell 1st *M*₂; paler brown clouds in cells *R*₂ and *R*₃, near mid-length and before the end of vein *M* and in the cubital and anal cells; veins brown. The female has the wing even more brilliantly variegated, the apical margin and veins beyond the cord seamed with brown. Venation: *Rs* long, about two and one-half times *R*₂₊₃; *R*₃ arcuated, bent toward *R*₄₊₅; petiole of cell *M*₁ shorter than *m*; *m-cu* punctiform.

Abdomen light yellow, the tergites with a conspicuous median dark brown stripe, on the fifth and succeeding segments including the entire sclerite except caudally; narrow and somewhat less distinct dark brown lateral stripes; styli

and apex of eighth sternal lobe yellow. Male hypopygium large, the sclerites fused into a ring; tergites 6 to 8 very narrow and telescoped. Ninth tergite transverse, obscure fulvous, with a large blackened area on either side at base; median area of tergite produced caudad into a slender deflexed median lobe, the apex of which terminates in two blackened lobules. Eighth sternite produced caudad into a long concave median lobe that is directed caudad, the apex dorsad, this boat-shaped structure clothed with yellow setæ. In the female the basal four tergites are bright orange, with conspicuous black median and sublateral stripes, the latter oblique, the lateral margins conspicuously silvery white; tergites 5 to 7 black with white lateral margins that become obsolete on the outer segments; sternites black, only the basal two segments obscure yellow, the lateral margins conspicuously whitened. Ovipositor with the ninth tergite fulvous, the sternite pruinose, the short fleshy tergal valves of the ovipositor brownish fulvous.

Hab. Japan (Houshiu).

Holotype, ♂, Mt. Akagi, Kotsuke-no-kuni, altitude 5580 feet, July 29, 1923 (*T. Esaki*).

Allotype, ♀, Lake Chuzenji, Shimotsuke-no-kuni, altitude 4170 feet, July 22, 1923 (*T. Esaki*).

This beautiful *Tipula*, together with *T. naviculifer*, Alexander, and *T. shogun*, Alexander, form a peculiar group of the genus.

Tipula patagiata, sp. n.

Belongs to the *tricolor* group; allied to *T. marginata*, Meigen; size very large (wing, ♂, over 23 mm.); costal margin of wing and the stigma dark brown; petiole of cell M_1 short; male hypopygium with the region of the tergite produced into a short, roughened median lobe that is subtended on either side by a more depressed wing.

Male.—Length 18 mm.; wing 23.5 mm.

Frontal prolongation of head brown, dark grey dorsally; nasus long and slender, brown, tufted apically with yellow setæ; palpi dark brown. Antennæ of moderate length, if bent backward extending a little beyond the wing root; basal three segments brown, the first a trifle pruinose, the third darker at tip; remainder of flagellum black, the segments moderately incised. Head light grey with a capillary brown median stripe that becomes narrow and finally obliterated in front, the vertical tubercle with an impressed line.

Pronotum and anterior mesonotum dark grey, the praescutum with three yellowish-brown stripes that are margined with dark brown, the median stripe further divided by a capillary dark brown median vitta; remainder of mesonotum lighter grey, the scutal lobes each with two subconfluent darker markings. Ploura with a clear silvery-grey pruinosity, the postnotal pleurotergite more yellowish. Halteres pale brown, the base of the stem brighter, the knobs somewhat darker. Legs with the coxae clear light grey; trochanters brownish yellow; femora yellowish brown, their bases clearer yellow, the tips passing into black; tibiae brown, soon deepening into black; tarsi long and slender, black. Wings tinged with brown, cells *C* and *Sc* conspicuously dark brown; costal prearcular region likewise dark, but the posterior prearcular cells more yellowish; a conspicuous yellow spot at proximal end of stigma; stigma dark brown, sending a seam over the anterior cord; conspicuous oblitative areas before the stigma and across the proximal end of cell 1st M_2 ; veins dark brown, more yellowish behind vein *Cu*. Venation: petiole of cell M_1 very short, less than one-half *m*.

Abdominal tergites buffy yellow, with a conspicuous dark brown stripe on either side of the conspicuous dorso-median line, these dark markings narrowly connected across the caudal margins of tergites 2 to 4, the fifth and succeeding segments nearly uniformly darkened; extreme caudal margins of the tergites pale; basal and intermediate sternites pale, the terminal segments dark grey with indistinct paler caudal margins. Male hypopygium with the tergite firmly fused with the sternite, the caudal margin of the former produced caudad into a relatively short, roughened, black median lobe that is subtended on either side by a more flattened wing.

Hab. Japan (Hokkaido).

Holotype, ♂, Mt. Moiwa, Ishikari-no-kuni, June 15, 1923 (*S. Kuwayama*).

Tipula patagiata is very different from the other described Japanese species of the *tricolor* group.

Tipula mendax, sp. n.

Allied to *T. yamata*, Alexander; wings with the base and costal region strongly yellowish; male hypopygium with the eighth sternite with a dense tuft of long yellow setae that are directed ventrad.

Male.—Length about 12 mm.; wing 14.5 mm.

Frontal prolongation of head buffy-yellow, the nasus concolorous, elongate, tufted with long yellow setæ; palpi pale brown. Antennæ of moderate length; scapal segments yellow; basal segment of flagellum cylindrical, brown, the ends paler, especially the base; remaining segments of flagellum dark brown, the incisures indistinctly paler. Head brownish grey, a little brighter grey adjoining the margins of the eyes; vertex with a very narrow but conspicuous black median line.

Pronotum more or less infuscated. Mesonotum bright fulvous-yellow, on the posterior sclerites fading into testaceous, the usual præscutal stripes obliterated or nearly so; lateral margins of the thoracic sclerites paler. Pleura pale buffy, the sternopleurite and meron conspicuously grey. Halteres pale brown, the extreme base of the stem light yellow, the knobs a little darker. Legs with the coxæ pale, the posterior coxæ more greyish; trochanters pale yellow; femora obscure yellow, the tips rather narrowly dark brown; tibiæ brownish yellow, the tips a little darkened; tarsi brownish black. Wings tinged with greyish yellow, the base and costal region strongly yellowish; stigma relatively pale, brownish yellow; space behind vein *Cu* strongly flavous; obliterative areas before the stigma and across the proximal end of cell 1st M_2 ; veins dark brown, more yellowish in the flavous areas. Venation: basal section of vein M_{3+4} shorter than the second section; cell 2nd *A* a little wider than in *T. yamata*.

Abdomen with the basal segments obscure yellow, soon passing into brown, the hypopygium dark brown; caudal margins of the segments narrowly, the lateral margins more broadly, pale, the latter indistinctly margined sublaterally with darker brown; sternites dark, especially the subterminal ones. Male hypopygium with the ninth tergite tumid, the caudal margin produced into two blackened triangular knobs, separated from one another by a relatively narrow V-shaped notch; these knobs are broad at base, the tips narrowed, the surface relatively smooth. Ventral surface of eighth sternite bearing a dense tuft of long yellow setæ that are directed ventrad.

Hab. Japan (Hokkaido).

Holotype, ♂, Sapporo, Ishikari-no-kuni, June 1923 (*S. Kuwayama*).

Tipula otiosa, sp. n.

General coloration light grey, the præscutum with three brown stripes; antennæ moderately elongated, the scape

yellow, the flagellum black; wings pale brown, the base and costal region yellowish, the disk variegated with subhyaline; abdominal tergites obscure yellow, trivittate with dark brown.

Male.—Length about 14.5 mm.; wing 16.5 mm.

Frontal prolongation of head light grey, moderately elongate, the nasus long and slender; palpi dark brown. Antennæ with scape yellow, the flagellum black; antennæ of moderate length, if bent backwards extending about to the base of the abdomen, the flagellar segments with relatively conspicuous basal swellings. Head light grey, the sides of the vertex behind a little infuscated; a capillary median brown vitta, extending in a delicate point on to the very low vertical tubercle.

Pronotum light grey. Mesonotal prescutum light grey with three brown stripes that are confluent in front, indistinctly separated behind; median stripe greyish brown, margined laterally with dark brown and with an indistinct capillary median vitta; lateral stripes solid, dark brown; pseudosutural foveæ linear, almost obsolete, their mesal ends punctiform; scutum dark grey, each lobe with two brown marks, the median area with a capillary brown vitta; scutellum with the median lobe light grey with a capillary brown vitta that becomes subobsolete on the postnotal mediotergite. Pleura light grey, the dorso-pleural membrane ochreous. Halteres obscure yellow, the knobs brown. Legs long and slender, the coxæ light brown; trochanters yellow; femora obscure yellow basally, soon passing into brown, the tip dark brown; remainder of legs dark brown. Wings with a pale brown tinge, more evident in the cells beyond the cord; wing-base, cell *Sc*, and, less distinctly, cell *C* bright yellow; indistinct brown seams along the anterior cord and basal deflection of *Cu*₁; stigma small, dark brown; whitish subhyaline areas in the base of cell *R*₂; a conspicuous band before the cord, including cell 1st *R*₁, the tip of *R*, and the bases of 1st *M*₂, *M*₄, and *Cu*₁; less distinct white areas across the bases of the anal cells and in cell 1st *A* at the end of vein 2nd *A*. Venation: *R*₂ persistent; *m* a little shorter than the petiole of cell *M*₁.

Abdomen with the basal tergite light grey; subbasal tergites yellow, trilineate with dark brown, on the subterminal segments the brown colour becoming more extensive and finally obliterating the ground-colour except for the ochreous lateral margins; sternites yellow, the basal and terminal sternites infuscated. Male hypopygium with the tergite black, the caudal margin with a U-shaped median

notch, the small lateral lobes obtusely rounded. Basistyle virtually fused with the sternite; outer dististyle an obscure yellow ear-shaped lobe, broadest just beyond the base, thence tapering gradually to the subacute apex. Ninth sternite extensive. Eighth sternite unarmed.

Hab. Japan (Honshiu).

Holotype, ♂, Mt. Takao, Musashi-no-kuni, altitude 1000–2000 feet, April 13, 1923 (*T. Esaki*).

Paratopotype, ♂.

Tipula pendula, sp. n.

General coloration grey, the præscutal stripes very indistinct; antennal flagellum black; wings with a pale grey tinge, the base and costal region yellow; wing-apex broadly darkened; a broad, conspicuous, whitish cross-band beyond the cord, nearly traversing the wing; male hypopygium with the caudal margin of the eighth sternite produced ventrad into a small tongue-like yellow lobe.

Male.—Length 16.5 mm.; wing 15.5 mm.

Frontal prolongation of head obscure yellow, the nasus relatively short with moderately elongate yellow setæ; palpi pale at base, the terminal segments passing into brown, the extreme apex of the last segment paler. Antennæ moderately elongate, if bent backward extending about to the base of the abdomen; basal segments obscure yellow; flagellum black, the base of the first segment narrowly paler. Head grey, the vertical tubercle a little brighter; centre of vertex with a very delicate brown vitta.

Pronotum dusky. Mesonotal præscutum dusted with yellowish grey, the lateral margins passing into grey, the usual stripes being rendered indistinct; scutum dark grey, the centre of each lobe with two blackish dashes; scutellum brown, dusted with grey; postnotal mediotergite light grey. Pleura light grey, the dorso-pleural membrane light yellow. Halteres light brown, the knobs infuscated. Legs with the coxæ pale, sparsely dusted with whitish; trochanters obscure yellow; femora obscure yellow, the tips broadly blackened, more extensively so on the fore femora where nearly the apical half is included; tibiæ and tarsi brownish black, the tarsi only a little longer than the tibiæ. Wings with a pale greyish tinge, the base and cells *C* and *Sc* yellow; stigma dark brown; wing-apex conspicuously brownish, extending basad to the fork of M_{1+2} ; a broad, conspicuous, white band beyond the cord, this only a little narrower than the dark apex, including the broad bases of cells R_2 , R_3 , R_4 , 2nd M_2 , M_3 , and Cu_1 , and about all of cell 1st M_2 ; a smaller paler

area before the stigma; obliterative areas across the end of R_s and proximal end of cell 1st M_2 ; veins dark brown, paler in the flavous areas. Venation: tip of R_2 preserved but without macrotrichiae on distal half; petiole of cell M_1 short, approximately one-half m ; cell 1st M_2 narrowed distally.

Abdomen with the basal segments obscure yellow, beyond the second segment gradually becoming infuscated; on the sixth and succeeding segments becoming almost black; caudal margins of segments 6 to 8 narrowly obscure yellow. Male hypopygium relatively small. Ninth tergite with the apex much narrower than the base, the caudal margin with a very narrow median split, the lateral lobes thus formed relatively slender, subacute, lying almost parallel to one another, these lobes paler than the remainder of the tergite; dorso-median line of tergite narrowly pale. Basistyle nearly complete, produced caudad into a relatively long acute point. Eighth sternite with caudal margin produced ventrad into a small, flattened, nearly glabrous, tongue-like yellow lobe that hangs pendulously.

Hab. Japan (Hokkaido).

Holotype, ♂, Maruyama, near Sapporo, Ishikari-nokuni, June 10, 1923 (*S. Kuyama*); collector's number 35.

Tipula turbida, sp. n.

General coloration of head and thorax grey, the præscutum with three plumbeous stripes; wings tinged with brown, conspicuously variegated with whitish subhyaline; radial cells all dark; male hypopygium with the eighth sternite unarmed.

Male.—Length 15–16 mm.; wing 17.4–18 mm.

Female.—Length about 17 mm.; wing 17.8 mm.

Frontal prolongation of the head and the nasus dark brown; palpi concolorous. Antennae of moderate length, if bent backward scarcely attaining the root of the halteres; scape yellow; flagellar segments brown with blackish basal enlargements. Head dark brownish grey.

Mesonotum dark grey, the præscutum with three plumbeous grey stripes that are little evident against the ground-colour, the median stripe faintly divided by a pale line; scutum grey, the lobes plumbeous grey; scutellum and postnotum brown, grey-pruinose. Pleura obscure ochreous, the anepisternum and pteropleurite grey, the ventral half of the sternopleurite and ventral margin of meron of the same colour. Halteres brown, the base of the stem and apex of

knobs paler. Legs with the coxæ and trochanters yellow; femora obscure yellow, the tips narrowly dark brown; tibiæ and tarsi brownish yellow, the tips scarcely darkened, the terminal tarsal segments infuscated. Wings strongly tipped with brown, the base and costal region more brownish yellow; conspicuous whitish subhyaline areas as follows: a conspicuous band before the cord extending from before the stigma across the outer ends of cells *R* and *M*, the basal half of cell 1st *M*, to the wing-margin in *Cu*, including also the bases of cells *M*₁, 2nd *M*₂, and *M*₃; a whitish area just beyond mid-length of cell *M*, followed by a brown cloud; a brown cloud at mid-length of cell *Cu*, preceded and followed by conspicuous whitish areas; radial cells entirely dark; veins dark brown, paler in the obliterative areas. Venation: *m* varying in length, from shorter than to a little longer than the petiole of cell *M*₁.

Abdomen yellow basally; on the second tergite a blackish sublateral stripe commences; on the third segment a median stripe of the same colour; on the intermediate segments these stripes widen, reducing the pale brown ground-colour, the lateral margins of the segments becoming broadly pale; segments 7 to 9 black except for very narrow lateral and caudal pale margins on segments 7 and 8 and the styli of the hypopygium. Male hypopygium with the tergite and sternite distinct, the basistyle fused with the latter except ventrally. Ninth tergite entirely black, with a median lobe as in the group. Outer dististyle flattened, irregularly rectangular, pale. Eighth sternite unarmed. The female is similar, the basal abdominal segments pale reddish brown, with narrow greyish caudal margins; on the fifth and succeeding segments this colour passes into black, the segments with narrow pale margins. Ovipositor with the bases shiny black, all the valves straight.

Hab. Japan (Honshiu).

Holotype, ♂, Lake Ozenuma, on boundary between Iwashiro-no-kuni and Kotsuke-no-kuni, altitude 5460 feet, July 26, 1923 (*T. Esaki*).

Allotype, ♀, Yumoto, Shimotsuke-no-kuni, altitude 4830 feet, July 23, 1923 (*T. Esaki*).

Paratopotype, ♂.

Tipula turbida belongs to the group of the genus including the following additional Japanese species:—*T. bipenicillata*, Alexander; *T. bubo*, Alexander; *T. kuzuensis*, Alexander; *T. saitamæ*, Alexander; and *T. tokionis*, Alexander.

Tipula nigrosignata, sp. n.

General coloration shiny yellow, the head, mesonotal præscutum and scutum, and apex of abdomen shiny black; wings tinged with pale brown; stigma largely yellow; male hypopygium with the caudal margin of the eighth sternite produced and tufted ventrally with yellow setæ.

Male.—Length about 15 mm.; wing 19 mm.; antenna 11.5 mm.

Frontal prolongation of head, with the nasus, black; palpi dark brown. Antennæ elongate, if bent backward extending to the base of the sixth abdominal segment; scape and basal segment of flagellum yellow; remainder of flagellum dark brown, the basal segments with the basal swelling a little darker. Head shiny black.

Pronotum yellow, shiny black medially. Mesonotal præscutum shiny black, the region of the pseudosutural foveæ paler, the postero-lateral portions slightly pruinose; scutal lobes brownish black; remainder of mesonotum obscure shiny yellow. Pleura shiny yellow, the sternopleurite a little darker. Halteres brownish yellow, the knobs dark brown. Legs with the coxæ and trochanters shiny yellow; femora brownish yellow, the tips conspicuously but rather narrowly blackened; tibiæ brownish yellow, the tips narrowly blackened; tarsi light brown, gradually passing into dark brown, the tips of the individual segments narrowly darker. Wings tinged with pale brown, the base and cells *C* and *Sc* more yellowish; stigma largely bright yellow, the distal end narrowly brown; anterior cord and longitudinal veins beyond the cord faintly seamed with darker brown; small isolated oblitrative areas before the stigma and across the proximal end of cell 1st M_2 ; veins dark brown. Venation: R_{2+3} long, straight, a little shorter than the arcuated sector; R_4 entire; petiole of cell M_1 a little longer than m ; $m-cu$ distinct.

Abdomen shiny obscure yellow; a blackish spot on either side at the base of second tergite; an indistinct sublateral stripe; segment 6 and succeeding segments black with faintly indicated pale margins on segments 6 and 7. Male hypopygium with the tergite and sternite distinct, the very extensive basistyle fused with the sternite except ventrally. Ninth tergite subquadrate, with a deep, linear, median notch, each lobe thus formed being obliquely truncated, the mesal apical angle produced caudad into a small black spine. Outer dististyle stout, black. Eighth sternite with the caudal margin produced caudad into a conspicuous lobe,

the apex of which bears a ventral tuft of conspicuous yellow setæ.

Hab. Japan (Honshiu).

Holotype, ♂, Lake Chuzenji, Shimotsuke-no-kuni, altitude 4170 feet, July 22, 1923 (*T. Esaki*).

Tipula querula, sp. n.

Allied to *T. nipponensis*, Alexander; antennal flagellum black; posterior vertex and occiput brown; median præscutal stripe bisected by a dark median vitta; pleura with a narrow oblique brown stripe; inner dististyle of male hypopygium without a caudal extension.

Male.—Length about 12 mm.; wing 14 mm.

Frontal prolongation of head yellow; palpi dark brown. Antennæ relatively short for a member of this group, the elongate basal segment of the scape yellow basally, the distal two-thirds brown; antennal flagellum black, the segments relatively short. Head yellow, the vertex and occiput brown, this including the median area.

Pronotum yellow. Mesonotal præscutum yellow with three broad brown stripes, the broad median stripe paler medially but split by a darker median vitta; anterior ends of lateral stripes confluent with the median stripe; scutum brown, the median area restrictedly yellow; scutellum with the median lobe yellow, the caudal margin infuscated; postnotum with the mediotergite yellow, the lateral portions, except behind, with a large brown cloud. Pleura yellow; an oblique line extends from the anterior spiracle across the anepisternum on to the dorsal portions of the sternopleurite; dorsal half of each postnotal pleurotergite infuscated, the ventral half yellow. Halteres brown, the extreme base of the stem and each knob yellow. Legs with the coxæ yellow; trochanters yellowish testaceous; femora obscure yellow, the tips conspicuously blackened; tibiæ pale brown, the tips narrowly infuscated; tarsi passing into black. Wings subhyaline; stigma dark brown; cell *Sc* and space behind vein *Cu* infuscated; brown washes on the branches of *Cu*; obliterative areas before and beyond the stigma and across cell 1st *M*₂; pale washes near outer end of cell *M* and in base of cell 1st *A*. Distal section of vein *R*₂ with macrotrichise on basal half. Venation: *m* about equal to petiole of 1st *M*₂.

Abdomen obscure yellow, the segments variegated with dark brown, more evident on the lateral and caudal portions of the sclerites. Male hypopygium with the ninth tergite

transverse, the caudal margin with a broad U-shaped median notch, the base of which is not toothed, the lateral lobes formed very obtusely rounded; dorsal surface and caudal margin of tergite with abundant setæ. Outer dististyle longer than in *T. ecaudata*, sp. n., the setæ of the lateral face longer and coarser than those of the mesal face; inner style a flattened, roughly quadrato blade, most nearly as in *T. ecaudata*, the cephalo-dorsal angle produced into a blackened tooth-like spine.

Hab. Japan (Honsiu).

Holotype, ♂, Iinoōmata, Iwashiro-no-kuni, altitude 3280-6235 feet, July 24, 1923 (*T. Esaki*).

Tipula ecaudata, sp. n.

Allied to *T. nipponensis*, Alexander; thoracic pleura with sparse dark markings; coxæ uniformly pale; inner dististyle of male hypopygium without a caudal extension.

Male.—Length about 8 mm.; wing 11.2 mm.

Female.—Length 11 mm.; wing 12.5 mm.

Frontal prolongation of head above light yellow, the sides and the palpi dark brown. Antennæ elongate, if bent backward extending at least to the root of the halteres; scape yellow; flagellar segments yellow, the basal enlargement of each segment black, the terminal segments more uniformly infuscated. Head yellow; a dark brown spot on the inner margin of the eye at narrowest part of vertex; lateral margins of posterior vertex and genæ brown.

Pronotum sulphur-yellow. Mesonotal præscutum light sulphur-yellow with three dark brown stripes that are confluent anteriorly, indistinctly separated behind; scutum yellow, the lobes dark brown; scutellum testaceous; postnotal mediotergite yellow, the lateral margins brown. Pleura light yellow, the propleura largely brown; a small brown spot behind the anterior spiracle and others on the cephalic margin of each of the anepisternum and sternopleurite; a small spot on the antero-dorsal angle of the pteropleurite. Halteres pale, the bases of the knobs darker. Legs with coxæ and trochanters yellow; femora brownish testaceous, the tips infuscated; tibiæ brown, the tips narrowly darker; tarsi passing into black. Wings pale grey, the stigma elongate-oval, dark brown; cell *Sc* and seams along vein *Cu* and its branches dark brown; pale areas beyond the stigma; a band extending from before the stigma across cell 1st *M*₂ and a large spot crossing vein *Cu* before its fork; veins dark brown. Venation: vein *R*₂ entire; *R*₃ one-half longer than *R*₄₊₅, nearly straight; cell 1st *M*₂ small.

Abdominal tergites pale brown, variegated with darker on the incisures, basal sternites more uniformly pale. Caudal margin of ninth tergite with a broad U-shaped notch, the margin chitinized, the base of the notch with a small blunt median tooth, the lateral lobes obtuse; dorsal surface of tergite with numerous trichiae. Outer dististyle short-cylindrical, setiferous; inner dististyle relatively small, appearing as a flattened blade jutting into the notch of the tergite, without the caudal lobe of *T. nipponensis*.

Hab. Japan (Saghalien and Honshiu).

Holotype, ♂, Lake Ozenuma, on boundary between Iwashiro-no-kuni and Kotsuke-no-kuni, altitude 5460 feet, July 25, 1923 (*T. Esaki*).

Allotopotype, ♀.

Paratypes, Iinoōmata, Iwashiro-no-kuni, July 24, 1923 (*T. Esaki*); ♂, Toyohara, Saghalien, July 21, 1922, at honey-bait trap (*T. Esaki*); ♂, Takinosawa, Saghalien, July 26, 1922 (*T. Esaki*).

Tipula sparsiseta, sp. n.

Allied to *T. insulicola*, Alexander; general coloration pale brown, the præscutal stripes little evident; antennæ elongate, bicolorous; knobs of halteres infuscated; wings yellowish brown, the stigma dark brown; sparse macrotrichiae in distal fifth of cell R_5 .

Male.—Length about 8 mm.; wing 10.6 mm.

Frontal prolongation of head obscure brownish yellow; palpi pale brown. Antennæ elongate, if bent backward extending approximately to the base of the third abdominal segment; base and basal segment of the flagellum yellow; second flagellar segment with the basal enlargement black, the remainder brownish yellow; on the following segments the distal portions of the segments become darker, so the apical six or seven segments are almost uniformly blackened. Head pale brownish grey, the posterior orbits narrowly pale, the vertical tubercle a little darkened.

Pronotum brown. Mesonotal præscutum brown with three reddish-brown stripes that are little evident against the ground-colour; scutum brown, the lobes darker brown; scutellum and postnotum brown. Pleura pale yellow, including the ventral angle of the postnotal pleurotergite. Halteres pale brown, the knobs dark brown. Legs with the coxæ and trochanters pale yellow; femora obscure yellow, brighter at base, the tips scarcely infuscated; tibiae brown; tarsi black. Wings with a uniform yellowish-brown

tinge, the stigma dark brown; base and cells *C* and *Sc* a trifle more yellowish; obliterative areas before the stigma and across cell 1st *M*₂; veins dark brown, those basad of the cord paler. A sparse line of about sixteen macrotrichiae occupies the middle of the distal fifth of cell *R*₅. Venation: *Sc*₂ joining *R* just beyond mid-length of the arcuated sector, the latter only a little longer than *R*₂₊₃; distal section *R*₂ complete, with numerous macrotrichiae; petiole of cell *M*₁ about one-fourth the cell; *m* very short; *m-cu* obliterated by punctiform contact of adjoining veins.

Abdomen with the basal tergites pale brown, the intermediate segments obscure yellow with the incisures infuscated. Ninth tergite of the male hypopygium with a median compressed blade, as in *T. insulicola* and related species.

Hab. Japan (Honshiu).

Holotype, ♂, Okai, Kotsuke-no-kuni, altitude 2150 feet, July 27, 1923 (*T. Esaki*).

Tipula mystica, sp. n.

Belongs to the *pribilofensis* group; antennæ elongate; wings with a strong though pale brown tinge, the obliterative areas small; ninth tergite of male hypopygium heavily chitinized throughout, the caudal margin with a V-shaped notch, the lateral lobes terminating in slender apical points that are directed ventrad.

Male.—Length about 17 mm.; wing 16.5 mm.

Frontal prolongation of head brownish yellow, the dorsum dusted with grey; nasus distinct; palpi with the basal segment pale brown, the terminal segments passing into brownish black. Antennæ elongate, if bent backward extending to beyond one-third the length of the long abdomen; scapal segments brownish yellow; first segment of flagellum black, paler at base; flagellar segments black, very deeply constricted near the middle, the apical enlargement being only a little smaller than the base. Head light grey, clearer adjoining the eyes, with a capillary median brown vitta.

Mesonotal præscutum yellowish grey with four light brown stripes, the narrow intermediate pair connected at their anterior ends and approximated posteriorly, a little darker in colour than the lateral pair; scutum grey, each lobe with two pale brown spots, the posterior one fainter; scutellum brown, darker medially at base, sparsely pruinose; postnotal mediotergite grey. Pleura light grey, the postnotal pleurotergite fading into greyish white. Halteres brownish yellow, the knobs infuscated. Legs with the coxæ dusted with grey, paler apically; trochanters obscure yellow; femora brownish

yellow, clearer basally, the tips broadly blackened; tibiae brown, the tips still darker; tarsi black. Wings with a strong pale brown suffusion, the base and costal region more yellowish; stigma small, pale brown; small obliterative areas before the stigma and across the proximal end of cell 1st M_2 ; veins dark brown. Venation: *m-cu* present, very close to the fork of *M*; petiole of cell M_1 a trifle longer than *m*.

Abdomen yellow, the tergites with a conspicuous dorso-median brownish-black stripe that is narrowly interrupted at the posterior margins of the segments; on segments 7 to 9 including most of the tergites; hypopygium blackened; sternites obscure yellow, basal sternites with a narrow transverse impressed line on the basal half of each. Male hypopygium of the type of *T. pribilofensis*; ninth tergite entirely blackened and chitinized, with a deep V-shaped caudal notch, the apices of the lobes thus formed somewhat rounded but produced beneath into more slender black points that are directed ventrad. Outer dististyle long and slender; base of the inner dististyle produced caudad in a flattened sharply pointed blade that is about one-half the length of the outer style. Eighth sternite produced caudad in a flattened shovel-shaped lobe as in the group.

Hab. Japan (Hokkaido).

Holotype, ♂, Sapporo, Ishikari-no-kuni, June 15, 1923 (*S. Kuwayama*).

The *pribilofensis* group (or subgroup of the *arctica* complex) includes the following previously described species:—*T. kamchatkensis*, Alexander (Eastern Siberia), *T. optiva*, Alexander (North-western United States), *T. pribilofensis*, Alexander (Pribilof Islands, Alaska), *T. subarctica*, Alexander (Alaska), and *T. tæniaster*, Alexander (Alaska).

XLVII.—*Notes sur les Cercopides de l'Amérique Centrale et Méridionale de la Collection de M. C. B. Williams et de la mienne.* Par le Dr. V. LALLEMAND (Uccle, Belgique).

Sous-famille des *CERCOPINÆ*.

Tribu *ISCHNORHINI*.

Laccogrypota partita.

Jacobi, p. 40, Arch. für Naturg. xxxvii. (1921) (*Ischnorhina*).

Equateur, province de Tungurahua, R. Lligua Banos, 5000 pieds, xii. 1917, 3 ♀ ♀ (*J. B. Rorer*).

Laccogrypota amazonensis, sp. n.

Tête, pronotum, écusson, base des élytres, base des ailes et prosternum, côtés des méso- et métasternum rouges, élytres sauf leur base, abdomen, pattes, milieu de méso- et métasternum, rostre, noirs. Ailes noirâtres sauf leur base. Antennes brunes. Rostre atteignant les hanches postérieures; une seule épine sur les tibias postérieurs; bord externe des élytres convexe.

Longueur totale 16 mm.; longueur des élytres 13 mm.; largeur des élytres 4.5 mm.

Habitat. Amazone; île.

Type: ma collection.

Ischnorhina williamsi, sp. n.

Tête noire, sauf la carène médiane du front qui est brune, le clypeus et le rostre qui sont ocre-jaune; extrémité du rostre brune. Pronotum ocre-brun devenant brun en arrière (un peu moins de la moitié); écusson brun antérieurement, devenant ocre-brun clair en arrière; élytres ocre-brun clair, à extrémité brun-chocolat, cette coloration n'atteint pas le bord apical lui-même et est étroitement bordée d'ocre-brun clair; ailes enfumées à base jaunâtre. Thorax et abdomen ocre-brun clair, les 2 derniers segments de celui-ci et les organes génitaux, bruns. Pattes (sauf les tibias antérieurs, les tarses et les épines, noirs) ocre-brun avec une légère teinte rougeâtre. Carène médiane du front en-dessous de la partie frontale du vertex se bifurquant et dessinant une fossette triangulaire. Ocelles très voisins l'un de l'autre, séparés par une carène médiane longitudinale. Bords latéro-antérieurs du pronotum droits et saillants; sur les tarses postérieurs deux épines.

Longueur totale 13.5 mm.; longueur des élytres 11 mm.; largeur des élytres 4 mm.; longueur du corps 9 mm.

Habitat. Equateur, Province del Oriente, Canelas, 1500 pieds, janvier 1918, 1 ♀ (*J. B. Rorer*).

Type: collection de M. Williams.

Tribu TOMASPINI.

Genre NEOLACCOGRYPOTA, n.

Genre intermédiaire entre les tribus Ischnorhinini et Tomaspisini.

Front à forte carène médiane, se bifurquant vers le haut et formant ainsi une surface triangulaire légèrement déprimée en dessous de la partie frontale du vertex, faces latérales

assez aplaties, seulement légèrement bombées, vu de côté le front dessine un angle aigu. Vertex fort déclive, sa partie frontale est concave à la partie antérieure. Ocelles gros, plus proches l'un de l'autre que les yeux, séparés par une carène longitudinale. Sur le pronotum densément et assez grossièrement ponctué en lignes plus ou moins transversales, une fine carène longitudinale. Sur l'écusson 3 fossettes, 2 petites antérieures latérales et une grande qui occupe la plus grande partie de la surface.

Elytres colorées, plus ou moins translucides, leur longueur égale 3 fois leur largeur, nervures médiane et cubitale réunies sur une certaine étendue sur le tiers antérieur du corium.

Rostre s'étendant jusqu'à l'extrémité des hanches médianes; une seule épine sur les tibias postérieurs.

Type du genre, *N. brunnea*, Lallemant.

Habitat. Amérique du Sud.

Le genre se reconnaît facilement par la carène qui se bifurque à la partie supérieure et par les faces latérales quelque peu bombées.

Neolaccogrypota brunnea, sp. n.

Tête rouge, sauf les antennes et une bande longitudinale s'étendant sur le milieu du vertex, la partie frontale du vertex et la surface triangulaire située sous celles-ci, qui sont noir-brunâtre. Yeux gris, tachés de brun; ocelles jaunes; second article du rostre brun; pronotum brun-acajou, la partie antérieure le long du bord antérieur est beaucoup plus claire, plus rougeâtre; écusson brun-acajou sur la grande fossette et rouge sur les 2 fossettes antéro-latérales et à l'extrémité; élytres brun-clair, plus ou moins translucides.

Ailes très légèrement jaune-brun, à base rouge, nervures d'abord rouges, puis un peu plus foncées que l'aile elle-même.

Sternum rouge, par places brun-rouge; pattes rouges, sauf les tarses, les épines, les tibias antérieurs, la base et l'extrémité des tibias médians. Abdomen brun-rouge à la face supérieure, rouge taché de brun à la face inférieure.

Longueur totale 17 mm.; longueur du corps 11 mm.; longueur des élytres 15 mm.; largeur des élytres 5 mm.

Habitat. Equateur, Province de Tungurahua, Normandie, Banos, xii. 1917 (*J. B. Rorer*).

Type: collection de M. Williams et la mienne.

Tomaspis ochraceorosea, sp. n.

Tête rosée, sauf l'extrémité du clypeus, le rostre, les antennes, une tache entre celles-ci et les yeux, et enfin le long

du bord interne des yeux une tache s'étendant jusqu'au bord postérieur du vertex noir-brun ; yeux gris tachés de noir. Pronotum rose, en avant acquérant progressivement une teinte de plus en plus ocre vers l'arrière. Écusson brun-noir. Élytres ocre-jaune, la base et les deux tiers antérieurs du bord externe roses ; ailes enfumées, à nervure plus foncées, à base jaune-rosé.

La face supérieure du corps est recouverte d'une villosité jaune d'or. Sternum, abdomen et pattes noirs, sauf le bord latéral du prothorax, qui est rosé et le mésothorax ocre-jaune. Front lisse, sans carène médiane, ni stries transversales, à partie médiane assez aplatie, vu de côté il ne montre pas d'angle et la ligne qu'il dessine n'est pas très convexe. Vertex aplati, sans carène médiane, à ocelles petits, rapprochés l'un de l'autre.

Pronotum sans carène, ni ligne médiane. Deux fortes épines sur les tibias postérieurs.

Longueur totale 11.5 mm. ; longueur des élytres 9.5 mm. ; largeur des élytres 3 mm.

Habitat. Equateur, Province de Tungurahua, Zunai Banos, 5000 pieds, décembre 1917 (*J. B. Rorer*).

Type : collection de M. Williams.

Monecphora williamsi, sp. n.

Vertex noir, teinté de rouge ; sur certains exemplaires la partie frontale du vertex, les bords latéraux et une tache près du bord postérieur sont rouges. Pronotum noir, ses bords (spécialement les latéro-antérieurs, qui le sont largement), ses fossettes et la partie antérieure de la carène médiane sont rouges. Écusson rouge-foncé, brunâtre par place. Les deux tiers antérieurs des élytres, ainsi qu'une tache près du bord costal au commencement du tiers apical, rouges ; le bord antérieur de la partie noire apicale présente en son milieu une encoche carrée. Front brun-clair rougeâtre ; rostre brun-rougeâtre à extrémité noire ; thorax noir ; prothorax bordé de rouge ; abdomen brun-rouge, cuisses brun-clair rougeâtre ; tibias et tarses noirs. Certains exemplaires ont leurs tibias postérieurs brun-foncé teinté de rougeâtre. Ailes enfumées à base rougeâtre. Rostre s'étendant jusqu'entre les hanches médianes. Mésothorax de même forme que celui des *Simeliria* (*Cosmoscartini*), ayant une protubérance thoracique quelque peu transversale et un bord postérieur légèrement foliacé. Rostre s'étendant entre les hanches médianes. Carène du front fortement saillante. Deux épines sur les tibias postérieurs, dont la plus petite

près de la base. Les élytres ont un réseau apical dense s'étendant sur les deux cinquièmes postérieurs.

Longueur totale 21 mm.; longueur du corps 15 mm.; longueur des élytres 18.5 mm.; largeur des élytres 6.5 mm.

Habitat. Equateur, Province de Tungurahua, environs de Puyo, 7000 pieds, décembre 1917 (*J. B. Rorer*).

Type: collections de M. Williams et la mienne.

Monecphora levigata, sp. n.

Front, vertex et pronotum noir-verdâtre, le pronotum dans sa partie postérieure prend progressivement une teinte rougeâtre, vertex brun-rougeâtre devenant rougeâtre postérieurement, élytres brun plus ou moins rougeâtre, à partie apicale brune, sur ceux ci 2 bandes plus ou moins évanescentes ou se décomposant en taches jaune-rougeâtre. Ailes enfumées, à base rosée.

Face supérieure du corps recouverte d'une villosité jaune. Clypeus et rostre rougeâtres, l'extrémité du dernier brune; pattes brun-rougeâtre foncé; pro- et mésosternum rouge-brun; métasternum rougeâtre. Abdomen rouge, à sa face inférieure une bande brune à la base de chacun des segments; front arrondi globuleux, ne montrant pas d'angle, vu de côté.

Ocelles jaune-rougeâtre, petits, presque contigus, séparés par une carène longitudinale. Sur le pronotum une fine carène; 2 fortes épines sur les tibias postérieurs.

Longueur totale 8.5 mm.; longueur des élytres 7 mm.; largeur des élytres 2.25 mm.

Habitat. Panama, Almirante, 4. ii. 1917 (*C. B. Williams*).

Types: collection de M. C. B. Williams et la mienne.

Monecphora reducta, sp. n.

Vertex, pronotum, écusson noir légèrement verdâtre, brillants. Pronotum étroitement bordé de brun au bord antérieur, écusson ocre-jaune sur les côtés. Elytres jaunes et noirs sur les quatre cinquièmes antérieurs, bruns sur le cinquième postérieur; sont jaunes: une bande le long du bord interne du clavus, une bande plus ou moins en forme de S partant de la base du bord costal, traversant le corium pour rejoindre l'extrémité de la bande du bord interne du clavus et une grande tache triangulaire, dont l'angle interne est obtus au bord externe au niveau de l'extrémité du clavus, la partie postérieure de cette tache devient blanc-jaunâtre.

Antennes, yeux, extrémité du rostre, pattes antérieures sauf la base des cuisses, tarses, tibias et extrémité des cuisses médians, extrémité des tibias postérieurs, leurs tarses et

leurs épines brun-noir. Face, clypeus, 1er article du rostre, thorax, base des cuisses antérieures, cuisses médianes sauf leur extrémité, pattes postérieures sauf l'extrémité des tibias, les tarses et les épines ocre-jaune, très légèrement teinté de brun, abdomen ocre-brun. Ailes hyalines, légèrement enfumées, à base jaunâtre.

Front globuleux, arrondi, à carène médiane très nette antérieurement, mais disparaissant vers le clypeus, à sillon transversaux légers.

Ocelles l'un près de l'autre, séparés par une carène longitudinale.

Face supérieure de l'insecte recouverte d'une villosité jaunâtre.

♀ diffère du ♂ en ce que le vertex, le pronotum sont ocre-jaune brunâtre, et que l'écusson est brun foncé.

Habitat. Panama : ♂ Ancon (27. i. 1917) (C. B. Williams) ; ♀, Balbao, Prado (ii. 1918) (H. I. Dietz).

Longueur 7 mm. ; longueur des élytres 5.5 mm.

♂, collection de M. Williams ; ♀, ma collection.

Monecphora incarnata, sp. n.

Tête, pro- et mésothorax, abdomen, pattes, écusson, noirs. Pronotum, élytres, bords latéraux du prothorax et sur celui-ci une tache ronde à la base des hanches. Mésothorax rouge-incarnat. Ailes enfumées, rougeâtres à la base. Segments abdominaux étroitement bordés de rouge. Sur la partie supérieure de l'insecte une villosité blanchâtre et sur la partie inférieure une villosité grise. Ocelles plus près l'un de l'autre que des yeux ; sur le front une carène médiane bien nette et de chaque côté des strics transversales ; vu de côté, le bord antérieur (carène médiane) est arrondi ; rostre s'étendant entre les hanches médianes ; sur les tibias postérieurs deux épines, dont la seconde est très forte.

Longueur totale 9 mm. ; longueur des élytres 7 mm.

Habitat. Equateur, Province de Tungurahua, Zunai Banos, 5000 pieds, xii. 1917 (J. B. Rorer).

Type : collection de M. Williams et la mienne.

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Sphenorhina normandiae, sp. n.

♀. Tête, extrémité du rostre, pattes antérieures et médianes, tibias et tarses postérieurs, pronotum ocre-jaune, ce dernier plus brunâtre en avant ; écusson et élytres ocre-jaune, la partie réticulée du corium est noirâtre et cette coloration s'avance en pointe obtuse sur la moitié de la

longueur de l'élytre. Thorax et cuisses postérieurs ocre-brun ; les hanches et le rostre, sauf son extrémité, sont de teinte beaucoup plus claire, presque ocre-jaune ; sur le mésothorax une grande tache noire. Abdomen noir, à segments finement bordés de brun-clair. Ailes enfumées surtout vers l'extrémité, à base jaunâtre. Front, vu de côté, s'avancant en angle à peu près droit, à forte carène médiane et à stries latérales ; deux épines sur les tarses postérieurs, la première assez petite.

Longueur totale 14 mm. ; longueur des élytres 11.5 mm. ; largeur des élytres 4 mm.

Habitat. Equateur, Province de Tungurahua, Normandie Banos, décembre 1917 (*J. B. Rorer*).

Type : collection de M. Williams.

Sphenorhina modesta, sp. n.

Tête, pronotum, partie antérieure de l'écusson, noirs, brillants. Partie postérieure de l'écusson, élytres, sauf leur extrémité (à peu près le cinquième postérieur) noir ; 1er article du rostre, pattes, thorax et abdomen rouge-brique ; élytres et surtout l'abdomen un peu plus foncés. Moitié inférieure des tibias antérieurs et médians, extrémité des tibias postérieurs, leurs épines et tous les tarses, second article du rostre rouge-brique brunâtre.

Tête de même forme que celle de *T. rubra*, extrémité vu de côté en angle aigu ; sur le front une carène médiane très nette et des sillons latéraux. Rostre dépassant légèrement les hanches médianes.

Longueur totale 11.5 mm. ; longueur des élytres 9.5 mm. ; longueur du corps 9 mm.

Habitat. Costa Rica.

Type : collection du Musée de Paris, celles de M. Williams et la mienne.

Sphenorhina undulata, sp. n.

Brun-noir, carène médiane du front, bord antérieur du vertex, bords latéro-antérieurs du pronotum, bords latéraux de l'écusson, deux lignes ondulées sur les élytres, base des ailes, une tache à l'extrémité des cuisses, hanches postérieures et une fine ligne au bord postérieur des segments abdominaux, rouges. Ailes enfumées. Front vu de côté relativement assez aplati et à carène médiane dessinant un angle très obtus, stries transversales sur les côtés.

Rostre atteignant les hanches postérieures ; deux fortes épines sur les tibias postérieurs.

Ocelles jaunâtres plus près l'un de l'autre que des yeux. Sur le pronotum une fine carène longitudinale.

Longueur totale 14 mm.; longueur des élytres 12 mm.; largeur des élytres 4.5 mm.

Habitat. Equateur, Province de Tungurahua, Yurugalpa, Banos, 5000 pieds, décembre 1917 (*J. B. Rorer*).

Type : collection de M. Williams.

Sphenorhina tucurricæ, sp. n.

Tête et face inférieure du corps ocre-jaune, sauf les épines et les griffes des tarses postérieurs (les tibias antérieurs et les médians manquent) ainsi que le rostre, qui sont noirs; l'abdomen a une teinte rosée.

Sur le vertex, une ligne médiane noire se prolongeant en triangle à la partie supérieure du front. Antennes noires; yeux gris tachés de brun. Pronotum noir sur la moitié postérieure, ocre-jaune sur l'antérieure, derrière le bord antérieur une tache noire médiane, de la largeur de l'espace interoculaire.

Ecusson de trois couleurs : tiers antérieur ocre-jaune, tiers médian brun-noir, tiers postérieur jaune-rouge. Les élytres ont la base ocre-jaune, puis une bande transversale brun-noir, ensuite une bande jaune-rougeâtre plus rouge vers l'extérieur, et le restant est brun-noir avec 2 grandes taches rouges finement bordées d'ocre-jaune; l'insecte vu d'en haut présente donc depuis le pronotum jusqu'à la partie brune des élytres cinq lignes transversales diversement colorées, allant d'un bord à l'autre. Ailes enfumées, à nervures noirâtres, à base jaune-rosé.

Front, vu de côté, montrant un angle obtus, ayant une carène médiane et des stries latérales nettes. Ocelles très rapprochés, presque contigus, séparés par une fine carène; pas de carène, ni de ligne sur le pronotum; deux épines sur les tibias postérieurs.

Espèce faisant partie du groupe de *Sph. lineata*, Walk., *bivittu*, Walk., *cruciata*, Walk., etc.

Longueur totale 8 mm.; longueur des élytres 6.75 mm.

Habitat. Costa Rica, Tucurrique.

Type : collection de M. Williams.

Sphenorhina rubra, var. *pallida*, n.

Diffère de l'espèce par la coloration de la tête, du pronotum et de la base de l'élytre qui jusqu'à la 1ère ligne jaune de couleur est ocre-brun clair, au lieu d'être rouge; tibias, tarses et antennes brun-noirâtre,

Contrairement à ce que j'ai écrit dans 'Genera Cercopidarum,' je considère *T. rubra*, Stål, et *T. sororia*, Germar, comme deux espèces très voisines, mais distinctes.

Sphenorhina croceofasciata, sp. n.

Tête noire, brillante, moitié postérieure du pronotum, base de l'écusson, élytres, tibias antérieurs et médians, tarses et épines noirs. Moitié antérieure du pronotum, point de l'écusson à partir du milieu de la fossette, une large bande sur le tiers antérieur des élytres, et une plus étroite au commencement du tiers apical, jaunes ; la seconde bande se dilate légèrement vers le milieu, puis arrivée près du bord externe se rétrécit un peu ; thorax, cuisses antérieures et médianes (sauf leur extrémité brune) et les pattes postérieures (sauf les griffes et les épines) rouge-carmin clair. Ailes enfumées un peu plus foncées à l'extrémité et jaunâtres à la base.

Front, vu de côté, s'avancant en un angle, dont le bord antérieur est convexe ; sur le pronotum une fine ligne longitudinale ; deux épines sur les tibias postérieurs.

Espèce voisine de *Sph. pallifascia*, Walk.

Longueur totale 11 mm. ; longueur des élytres 9 mm. ; largeur des élytres 3.5 mm.

Habitat. Equateur, Paramba.

Type : collection de M. Williams.

Sphenorhina victoriæ, sp. n.

Tête noire, légèrement rougeâtre, bords latéraux du vertex rouge-grenat ; pronotum noir-rougeâtre devenant progressivement rouge-grenat au bord antérieur et le long des bords latéro-antérieurs. Ecusson noir, rosé à la partie apicale (à partir de l'extrémité de la fossette).

Elytres noirs, portant 2 bandes jaunes de même largeur, une près de la base et l'autre devant la partie réticulée.

Ailes légèrement enfumées, plus foncées à l'extrémité, à base rosée. Rostre jaune-rougeâtre, à extrémité noirâtre. Pro- et mésothorax noir-rougeâtre, plus clairs par places ; métathorax jaune-rougeâtre.

Abdomen noir teinté de rouge, au bord postérieur des segments une bande carmin, plus large au milieu, dernier segment carmin et les organes génitaux ocre-brun.

Tête, vue de côté, s'avancant en pointe (en angle obtus), sur les côtés des sillons transversaux ; sur le pronotum, un sillon longitudinal médian.

Longueur totale 10.5 mm. ; longueur des élytres 8.5 mm. ; largeur des élytres 3.5 mm.

Habitat. Equateur, Province de Guayas, Victoria (Côte du Pacifique), xii. 1917 (*J. B. Rorer*).

Type: collection de M. Williams.

Espèce faisant partie du groupe constitué par *Sph. decernens*, Walk., *pallifascia*, Walk., *latifascia*, Walk., *tricolor*, Guérin, *distinguenda*, Walk., *croceifasciata*, Lallemand, *rubra*, Lin., et *sororia*, Germ., etc.

Sphenorhina nigrotænia, sp. n.

Vertex, pronotum, écusson, base des élytres et sur celles-ci une bande transversale au devant de la partie réticulée, rouges; une large bande médiane et la partie apicale réticulée des élytres noires; yeux, second article du rostre, tibias antérieurs et médians, tarses et épines bruns; abdomen ocre-brun très clair légèrement rougeâtre; front, sternum, cuisses antérieures et médianes, pattes postérieures d'un rouge plus clair qu'à la partie supérieure du corps.

Front à carène saillante, à stries latérales nettes, vu de côté s'avancant en pointe obtuse, bord antérieur légèrement convexe, bord inférieur droit.

Longueur totale 11 mm.; longueur des élytres 9 mm.; largeur des élytres 4 mm.

Habitat. Equateur, Province de Tungurahua, Maras.

Type: collection de M. Williams et la mienne.

[NOTE.—All the specimens referred to in the above paper as being in the collection of Mr. C. B. Williams will shortly be handed over to the British Museum, together with other Central-American Cercopidæ.—C. B. W.]

XLVIII.—*A Contribution to our Knowledge of the Corrodentia-Fauna of South Saghalien.* By HANJIRO OKAMOTO and SATORU KUWAYAMA, Sapporo, Hokkaido, Japan.

[Plate VIII.]

THE order Corrodentia was not known to occur in southern Saghalien until 1911, when Professor S. Matsumura recorded a species—*Cæcilius oyama*—which had hitherto been known only from Hokkaido and Honshu*. In the fall of 1921 one of the authors—Kuwayama—had the opportunity of making a trip to the island in question, when a small collection of the insects of this order was made and two additional species discovered. One of these latter is new to science, while the other had not been recorded from the island.

* S. Matsumura, "Erster Beitrag zur Insekten-fauna von Sachalin," *Japan. Coll. Agr. Tohoku Imp. Univ.* vol. iv. pt. 1, pp. 17-18 (1911).

Family **Psocidæ**.

Subfamily **Psocinæ**.

Genus **PSOCUS**, Latreille (1796).

1. *Psocus mali*, Okamoto, Trans. Sapporo Nat. Hist. Soc. vol. ii. p. 126, pl. ii. fig. 5 (1907-08).

Nom. Jap. Ringo-chatate.

Local Distribution. Nakazato, Odomari District (2 ♀ ♀ collected by S. Kuwayama on September 2, 1921).

General Distribution. Saghalien, Hokkaido, Honshu.

This species had not been recorded from South Saghalien.

2. *Psocus saghalienensis*, sp. n.

Head pale yellow to greyish white, sparsely greyish pubescent. Clypeus large and semicircular, projecting in front, margined with brown and striped longitudinally with from twelve to fifteen brownish lines which do not attain the lower margin; the median lines are mostly dark, the lateral ones becoming gradually paler and shorter outwardly, the shade varying according to the individual. Clypeolus small and narrow. Labium large and somewhat rectangular, dark brown, with a short process on the centre of its upper margin. Mandibles paler, with brownish margins. Maxillary palpi prominent, four-segmented; first segment somewhat slender, thickened at base; second segment twice as long as the first; third shorter than the first; fourth subequal to the second and rounded at its apex; palpi greyish in colour excepting the dark brownish terminal segment. Eyes blackish, projecting hemispherically. Antennæ very slender and rather densely hairy, brownish, excepting the two basal segments; first and second segments short and thick, the former somewhat longer than the latter, yellowish brown, scarcely hairy, with a brownish patch outwardly; third segment largest, the segments becoming gradually shorter toward the apex. Ocellar triangle small, blackish brown, the ocelli projecting. Impressed longitudinal median line of occiput black and narrow, beyond the upper margin of clypeus coloured with a brownish band; along each inner margin of the eyes is an extended patch consisting of many small dark brownish spots.

Pronotum flat, the posterior half hidden beneath the large mesonotum, greyish white with pale brownish patches. Meso- and metanota bright blackish brown, excepting the paraptera and both sides of the meso-præscutum, which are of a greyish-yellow colour. Sternum and pleura greyish yellow.

Abdomen greyish yellow, oval in shape; each segment with small pale brownish spots above and with similarly coloured patches on both sides of the basal half of the segments; fore and lateral margins of the first segment coloured with yellowish brown. Genitalia of both sexes very complicated in structure, as shown by Pl. VIII. figs. 7, 8; in the male broadly enlarged, with a blackish-brown chitinized plate above; in the female the coloured portion is restricted to the terminal segment.

All pairs of legs similar in shape, yellowish in colour; femora with sparse yellowish hairs; tibiae densely provided with similarly coloured setæ with brown bases; spur yellow; tarsi consisting of two segments in the ratio of 3 to 1; ctenidia of posterior tarsus enumerating 27 on first segment and 4 on second segment; unguis divided into two parts, the basal half dark brownish, the terminal half somewhat paler, with a short tooth-like process on its inner margin.

Fore wing hyaline, scarcely tinged with pale brown; veins yellowish brown with the exception of the fork of R_{2+3} and R_{4+5} , near the tip of Cu_2 , and a short distance immediately before the areola postica of M , which are yellowish white and slender. In the male the pterostigma is moderately angulate behind, greyish, with a small yellowish-brown spot at its base, the apical half occupied largely by a yellowish-brown patch that extends into its posterior margin. The tips of veins An and Az broadly tinged with yellowish brown. Areola postica subtriangular, moderately high, and not acute at the tip. In the female the yellowish-brown patch of the pterostigma is much smaller and limited in extent; a diffuse pale yellowish-brown cloud on the basal half of cell Cu . In other respects the female agrees with the male. Hind wing hyaline, the veins uniformly yellowish brown; a pale yellowish-brown area along the margin along the inner side of An .

Measurements:—Length of body, ♂ 3.5–4.0, ♀ 4.2–4.5 mm.; length of fore wing, ♂ ♀, 4.5 mm.; width of fore wing, ♂ ♀, 1.7 mm.

Nom. Jap. Karafuto-chatate.

Local Distribution. Nakazaro, Odumari District (many ♂ ♀ collected by S. Kuwayama on September 2, 1921).

General Distribution. Saghalien.

Described from 5 ♂ ♂ and 3 ♀ ♀. The type-specimens (alcoholic co-types) are preserved in the collections of both authors. These insects were found on the bark of the stump of a tree in forest.

Psocus saghalienis bears a close resemblance to *P. pellucidus*, Okamoto, differing as follows:—(1) in being somewhat larger in size; (2) antennæ not blackish; (3) tarsi not dark

in colour and with many ctenidia on the first segment of the posterior pair; and (4) the patch of the pterostigma not displaying reddish-brown colours.

Family Cæciliidæ.

Subfamily CÆCILIINÆ.

Genus CÆCILIVS, Cuvier (1837).

3. *Cæcilius oyamae*, Enderlein, Zool. Jahrb., Abt. f. Syst. vol. xxiii. p. 252, tab. x. fig. 8 (1906); Okamoto, Trans. Sapporo Nat. Hist. Soc. vol. i. p. 199 (1906); id., Ann. Mus. Nat. Hungar. vol. viii. p. 205 (1910); Matsumura, Journ. Coll. Agr. Tohoku Imp. Univ. vol. iv. pt. 1, p. 17 (1911).

Nom. Jap. Shiromon-kechatate (Oyama-chatatemushi).

Local Distribution. Kaitsuka (or Solowiyofka), after Matsumura; Nakazato, Odomari District (1 ♀, collected by S. Kuwayama, Sept. 2, 1921).

General Distribution. Saghalien, Hokkaido, Honshu.

EXPLANATION OF PLATE VIII.

- Fig. 1. *Pocus saghalensis*, sp. n. Head of male, dorsal aspect.
Fig. 2. Ditto. Fore wing of male.
Fig. 3. Ditto. Pterostigma of fore wing of female.
Fig. 4. Ditto. Hind wing of male.
Fig. 5. *Pocus pellucidus*, Okam. (for comparison). Fore wing.
Fig. 6. *Pocus saghalensis*, sp. n. Unguis of hind leg.
Fig. 7. Ditto. Genitalia of female, lateral aspect.
Fig. 8. Ditto. Genitalia of male, lateral aspect.

(Figures much enlarged.)

XLIX.—*Descriptions of some new Leeches from India, Burma, and Ceylon.* By W. A. HARDING, M.A., F.L.S.

[Plates IX.—XV.]

THE small collection of Hirudinea here described consists of seven new species of Rhynchobdellæ. For the material upon which the five species *Pontobdella loricata*, *P. aculeata*, *Helobdella nociva*, *Placobdella fulva*, and *Paraclepsis prædatrix* were founded, I am indebted to the late Dr. N. Annandale, of the Indian Museum, who provided me also with valuable notes upon the coloration of several of these species during life, supplemented in two cases by water-colour drawings. My thanks, again, are due to Dr. Guy A. K.

Marshall, C.M.G., Director of the Imperial Bureau of Entomology, for examples of a leech parasitic on freshwater crabs (*Paraclepsis vulnifera*), and also to Mr. Clifford Dobell, F.R.S., who enabled me to establish the species *Placobdella undulata* by placing at my disposal the necessary material, collected by himself.

Suborder RHYNCHOBDELLÆ.

Family Ichthyobdellidæ.

Genus PONTOBDELLA, Leach, 1815.

Pontobdella loricata, sp. n. (Pl. IX.)

Description. Body of the single individual examined fusiform, somewhat flattened (being undistended by food), and faded in alcohol to a uniform greyish-green colour, unrelieved by special markings. The anterior sucker is circular, cupuliform, excentrically attached, with three pairs of inconspicuous submarginal papillæ. It comprises the first four somites and the greater part of the fifth.

Posterior sucker circular, centrally attached, not wider than the anterior sucker or the greatest width of the body. Both suckers have corrugated edges.

Rings, sixty-two behind the anterior sucker. Complete somite triannulate, consisting of a broad middle ring (lodging a ganglion of the ventral chain) lying between two smaller rings of equal width.

Somites vii.-xi. and xiii.-xxiv. complete with three rings; xii., xxv., xxvi., and xxvii. biannulate.

The clitellum is conspicuous and comprises the seven rings lying between the broad middle annuli of somites x. and xiii. Ring 19 is subdivided above.

The tubercles upon the rings vary a good deal in number, size, and position, so that it is only possible to give what may be regarded as a normal arrangement. This arrangement, shown, as far as the dorsal surface is concerned, in Pl. IX., may be described as follows:—

The broad middle ring of the somite bears on its whole circumference eight large conical tubercles, four above and four below. The exterior dorsal warts are submarginal, so that their points appear in a ventral view. The narrow rings on either side of the middle one each bear a total of fourteen tubercles, a pair of marginal tubercles being present in addition to six above and six below.

The warts here described occasionally may be missing or out of their normal position, and other tubercles, generally of

small size, may be interposed between them. On the ventral surface of the middle ring of the somite a small tubercle often occurs between the middle pair of warts.

The mouth-opening occupies a nearly central position within the anterior sucker.

The male genital orifice lies between rings 17 and 18—that is, between the second and third rings of somite xi.; the female opening appears between rings 19 and 20, in the middle of somite xii. Crop with a sacculated, single, undivided cæcum.

The anus opens between rings 59 and 60, in the middle of somite xxvi., being separated by three annuli from the posterior sucker.

Dimensions. Approximate total length, in alcohol, 74 mm.; approximate greatest width 7 mm.

Hosts and habitat. The example here described was taken at Station 233, Marine Survey of India. No host is recorded.

Pontobdella aculeata, sp. n. (Pl. X.)

Description. Body fusiform, more or less circular and much attenuated anteriorly. One of the two individuals examined, in alcohol, had assumed a uniform dull grey hue devoid of special markings; the other was of a reddish-brown colour, with a dorsal pair of dark brown linear spots on the primary ring of each somite. These spots appeared to recur metamERICALLY throughout the body, but were difficult to detect posteriorly owing to the imperfect preservation of the material.

Anterior sucker small, circular, without papillæ, with corrugated edges, and comprising somites i.-iv. and the whole or the greater part of somite v.

Posterior sucker smaller than the anterior, with corrugated edges, circular, and centrally attached.

Rings, seventy-five behind the anterior sucker. Complete somite quadriannulate, the four annuli being of nearly equal width. The second of these, perforated by the nephridiopores, is here regarded as the primary ring of the somite, although it does not entirely cover a ganglion of the ventral chain. The ventral ganglia, throughout the greater part of the body, lie almost exactly between this second ring and the one posterior to it.

Somites ix., x., and xiii.-xxiv. complete with four annuli; vii., viii., xi., and xii. triannulate; xxv. biannulate; xxvi. and xxvii. uniannulate.

The clitellum is inconspicuous and apparently comprises the seven rings 17-23. The arrangement of the warty

tubercles on the body is shown in Pl. X., and may be described as follows:—

(1) Each annulus bears two lateral tubercles, which are larger on the third than on the other annuli of the somite. These tubercles form two conspicuous rows lying along the margins of the body.

(2) Dorsally the first and third rings of the complete somite bear a paramedian pair and the second and fourth rings a paramarginal pair of tubercles together with a median one, so that, throughout the greater part of the body, the tubercles on the upper surface are disposed alternately in twos and threes, forming a symmetrical pattern.

(3) On the otherwise bare ventral surface of each ring is a paramarginal pair of prominent tubercles. These tubercles constitute two conspicuous ventral rows, which form a characteristic feature of the species.

The mouth opens in a nearly central position within the anterior sucker.

The male genital pore opens between rings 19 and 20, the second and third rings respectively of somite xi.; the female opening lies between rings 22 and 23—that is, between the second and third rings of somite xii.

The crop has a single undivided cæcum, and the anus perforates the seventy-fourth or penultimate ring. The nephridiopores open in a paramarginal position in the second ring of the complete somite. Thirteen pairs of these pores were observed, but the examination of fresh material will be necessary before their full number can be determined.

Dimensions. Approximate size, in alcohol, total length 6½ mm.; greatest width 8 mm.

Hosts and Habitat. Of the two individuals examined, one was found at the Gregory Isles, Mergui Archipelago, Burma, and the other was taken in the estuary of the Bassein River, Buima, from *Harpodon nehereus*, a fish well known in a preserved state as the table delicacy “Bombay Duck.”

Family Glossosiphonidæ.

Genus *HELOBDELLA*, R. Blanchard, 1896.

Helobdella nociva, sp. n. (Pl. XI.)

Description. Body claviform, with the head-region somewhat dilated, without the dorsal scute which forms so conspicuous a feature in more than one member of this genus. Anterior sucker with fine transverse ribbing on its inner surface. Posterior sucker small, less in width than half the greatest width of the body. A water-colour drawing from

life, sent with the material by the late Dr. Annandale, shows a translucent body (through which the dark contents of the digestive tract can be discerned), of a pinkish hue where thinnest, dull green in the thicker parts, with five brown, longitudinal, dorsal stripes, of which one is median, and having the bluish-grey posterior sucker rayed with white.

Rings seventy. Ring 9 is the first to encircle the body, and so forms the first ventral annulus; ring 68 is double at the margins, but not entirely divided.

The single pair of eyes lie in ring 4.

Two dorsal pairs of papillæ (all that could be made out in the individuals examined), situated one pair on either side of the median line, distinguish the middle or primary ring of each somite. Somite i. uniannulate, ii., iii., iv. biannulate, the nineteen somites v.-xxiii. complete with three rings. Somites xxiv.-xxvii. are represented by the six rings 65-70.

The reproductive and alimentary systems are shown in Pl. XI. (the parts indicated by the dotted lines were not clearly seen, owing to the defective state of the material).

The male genital orifice lies between rings 28 and 29—that is, between somites xi. and xii. The female orifice is separated from the male by two annuli, being situated between rings 30 and 31, in somite xii.

The genital organs call for no special comment, with the exception of the ovaries, which are much coiled and very long, extending as far as somite xvi.

The mouth opens within the anterior sucker a little in advance of the centre. The seven pairs of crop-cæca are somewhat lobed. The anus opens between rings 69 and 70, being separated by one ring from the posterior sucker.

Dimensions. Approximate size of largest individual—total length 7.5 mm.; greatest width 1.5 mm.

Host and Habitat. No host is recorded. The leeches examined came from two sources, some being found upon the stems of water-plants and on the under surface of *Canna* leaves dipping into the water in a small pond at Puri, Orissa, India, and others being taken from the under surface of bricks and broken earthenware pots in a tank at Kidderpore, Calcutta.

Genus *PLACOBDELLA*, R. Blanchard, 1893.

Placobdella undulata, sp. n. (Pl. XII.)

Description. Body elliptic-lanceolate, with the head-region somewhat dilated; in adult individuals there is a slight constriction centred at the thirtieth ring, immediately behind the female orifice. Dorsal surface with a roughened appearance

due to the presence on each ring of numerous closely-set papillæ. Posterior sucker circular or slightly oval, centrally attached, about equal in width to half the greatest width of the body. Colour faded in alcohol to a uniform buff hue.

Rings seventy-one. Ring 2 is double at the margins, but not entirely divided.

Somites i.-iv., which could not be plotted with certainty in the material examined, appear to be represented by rings 1-6, which overlie the anterior sucker. Somites v.-xxiv. complete with three annuli, xxv. and xxvi. biannulate; xxvii. uniannulate. Rings 7 and 8, the first and second rings respectively of somite v., unite below to form the first ventral ring; somite v., therefore, is only triannulate dorsally.

There is one preocular ring; the single pair of eyes lie within annuli 2 and 3.

Male genital orifice situated between rings 27 and 28—that is, between somites xi. and xii. The female orifice lies two rings behind the male, in somite xii., between rings 29 and 30. The anus opens between rings 70 and 71, thus being separated by one ring from the posterior sucker.

The reproductive and alimentary systems are shown in Pl. XII., and conform in all important particulars to the general plan characteristic of this genus. The mouth opens in the usual terminal position; the salivary glands form paired compacted masses; the seven pairs of crop-cæca are moderately lobate; the paired pouches of the stomach are somewhat less developed than usual.

Dimensions. Approximate size of the largest example—total length 17.5 mm.; greatest width 4 mm.; width of posterior sucker 2 mm.

Host and Habitat. The leeches examined were collected in the Colombo Lake, Ceylon, and were said to have been taken from Koraliya fi-h (*Etioplus suratensis*, Block).

I am much indebted to Mr. Clifford Dobell, F.R.S., for the material upon which this species has been founded.

Placobdella fulva, sp. n. (Pl. XIII.)

Description. Body flattened, in extension claviform and very slender anteriorly. Upper surface of a bright reddish-yellow hue, having, in addition to the deep brown markings described below, a conspicuous longitudinal median cream-coloured stripe and a pair of broken marginal cream-coloured bands. Ventral surface white. Dorsally each ring bears a large median papilla, and these papillæ form a prominent row corresponding to the median cream-coloured stipe. An intermediate and a marginal pair of papillæ present on the

dorsal surface of the middle or primary ring of each somit are covered by deep brown spots which are connected longitudinally by paler brown lines. Head-region undilated and continuous with the body. Posterior sucker small, centrally attached, not wider than half the greatest width of the body, with paired cream-coloured rays.

Rings 67. Ring 5 forms the posterior boundary of the anterior sucker and is the first to appear on the ventral surface. Ring 63 is doubled at the margins, but not entirely divided.

Somites v.-xxii. complete with three annuli.

The single pair of eyes lie within ring 2, there being one præocular ring.

The male genital pore is situated between rings 26 and 27—that is, between the first and second annuli of somite xi.; the female pore opens between rings 28 and 29—that is, between somites xi. and xii.

The anus lies between rings 66 and 67, being separated by one ring from the posterior sucker.

[The accidental destruction of the two individuals upon which this species is founded prevented the complete investigation of the internal features.]

Dimensions. Approximate total length 13 mm.; approximate greatest width 2 mm.

Hosts and Habitat. The leeches examined were found on a dead *Unio* shell at the edge of a stream at Purulia, Maubhum dist., Chota Nagpur div., Bengal.

PARACLEPSIS, gen. nov.

Glossosiphoniæ of medium size, with three pairs of eyes. Complete somite formed of three rings. Mouth-openings subterminal, leaving the anterior sucker imperforate. The crop, which has more than seven pairs of lateral diverticula, extends in front of the genital apertures, though not so far forward as in Hemiclepsis.

The two species representing this new genus possess a curious combination of features, viz., the three pairs of eyes usually seen in *Glossosiphonia*, a subterminal mouth-opening which closely approximates in position to the mouth-opening seen in *Placobdella*, and an extension of the crop anterior to the genital orifices, largely resembling the same feature occurring in *Hemiclepsis*, although the development is not carried to the same degree.

Paraclepsis prædatrix, sp. n. (Pl. XIV.)

Body ovate-acuminate, smooth below, with a roughened or crustaceous dorsal surface due to numerous small papillæ

closely set on every ring. A series of larger dorsal papillæ are present on the middle ring of each somite, and these consist of three pairs, occupying respectively a paramedian, an intermediate, and a paramarginal position. The head-region is separated from the rest of the body by a slight constriction.

I am indebted to the late Dr. Annandale for the following description of the coloration of a living example of this species collected by him:—"Semiopaque pinkish white, profusely ornamented with dull green pigment-cells on the dorsal surface. On the anterior and posterior thirds of the body these cells formed a broad and somewhat irregular longitudinal band interrupted along the middle by a colourless line; a transverse colourless line ran across the body just behind the 'head,' which was profusely covered with green pigment-cells. On the middle of the body the pigment-cells were arranged in a comparatively narrow stripe, still interrupted longitudinally, but giving rise to transverse bars which were expanded and proliferated at their free extremity in such a way that a kind of network was produced. The posterior sucker bore faint radiating green lines."

Anterior sucker with the characters of the genus. Posterior sucker centrally attached and rather less in diameter than the greatest width of the body. It bears a series of submarginal papillæ.

Rings 73, of which two are præocular. Ring 71 is double at its margins, but is not divided throughout.

Somites i., xxiv., xxv., xxvi., and xxvii. biannulate; ii. uniannulate; the twenty somites iv.-xxiii. complete with three rings.

The three pairs of eyes are disposed in two subparallel rows. The first and second pairs lie respectively in rings 3 and 4; the third pair, separated from the others by the space of two annuli, lie in ring 7.

The male genital orifice is situated between rings 29 and 30—that is, between somites xi. and xii.; the female orifice lies two rings behind the male, between rings 31 and 32, in somite xii.

The reproductive organs and alimentary tract are represented schematically in Pl. XIV. Large vesiculæ seminales connect the vasa deferentia with the ejaculatory canals, and descend to about the fifteenth somite. Having reached its lowest point, each vesicula returns upon itself, and the ascending and descending portions are closely united for a considerable distance. Five pairs only of testes could be found in the material examined. The ovaries consist of paired simple sacs. The crop arises between somites x. and

xi. Its anterior portion expands bisymmetrically, but somewhat irregularly, and it is not until the twelfth somite is reached that the typical Glossosiphonid type of diverticula appear.

The salivary glands take the form of compact bunches closely resembling the same features in *Placobdella*.

The anus opens between the seventy-second and the last ring.

Dimensions. Large individuals (in alcohol) attain a length of about 15.5 mm. and a width of about 4 mm.

Hosts and Habitat. The only host noted is *Emyda vittata*, Peters, and the leeches were found either upon their host or in ponds or pools frequented by this freshwater tortoise. The material was collected in various places in Northern, Southern, and Eastern India.

Paraclepsis vulnifera, sp. n. (Pl. XV.)

The general form of this species resembles that of *Paraclepsis prædatrix*, with the exception of the head-region, which is continuous with the body and not separated from it by a posterior constriction. The condition of the material was unfavourable for the observation of colour and papillæ. Posterior sucker small, centrally attached, and less in diameter than half the greatest width of the body.

Rings seventy. Rings 2 and 69 are doubled at their margins, but not entirely divided. Rings 7 and 8 unite below to form the first ventral ring.

The first somite is uniannulate, and the second is represented by the anterior part of ring 2, containing the first pair of eyes. Somite iii. includes the posterior part of ring 2 together with ring 3. The twenty somites iv.-xxiii. are complete with three rings, and xxiv.-xxvii. are represented by the last seven rings.

The three pairs of eyes are disposed in two subparallel rows. The small and circular first pair are closely approximated in the anterior part of ring 2; the second and larger pair lie in the posterior part of the same ring, and the third and largest pair are situated somewhat wider apart in ring 5.

The male genital orifice opens between rings 27 and 28—that is, between somites xi. and xii.; the female orifice is separated by two rings from the male, and lies between rings 29 and 30, the second and third rings of somite xii.

The reproductive and alimentary systems are shown in Pl. XV. The large vesiculæ seminales seen in *P. prædatrix* are absent, but the salivary glands and crop bear a close resemblance to the same features in the latter species.

The crop arises in the anterior part of somite x. The anus lies between rings 72 and 73, being separated by one ring from the posterior sucker.

Dimensions. Approximate length 14 mm.; approximate width 8 mm. Living individuals probably attain a greater length.

Host and Habitat. The leeches examined were taken from the branchial chambers of freshwater crabs (*Paratelphusa* sp.) at Mauganaltur, Tanjore District, Madras. They had been sent by Mr. Ballard, Government Entomologist, Madras Province, to Dr. Guy A. K. Marshall, O.M.G., Director of the Imperial Bureau of Entomology (Colonial Office), who was good enough to place the material at my disposal.

EXPLANATION OF THE PLATES.

PLATE IX.

Pontobdella loricata, sp. n. Diagram showing external features of the dorsal surface. Somites numbered in Roman and rings in ordinary figures. *an.*, anus.

PLATE X.

Pontobdella aculeata, sp. n. Diagram showing external features on the left of the dorsal and on the right of part of the ventral surface. Somites numbered in Roman and rings in ordinary figures. *p.s.*, pigment-spots; *mt.h.*, mouth-opening; *an.*, anus; *np.*, position of nephridiopores on ventral surface.

PLATE XI.

Helobdella nociva, sp. n. Diagram showing external features and the reproductive and alimentary systems. Somites numbered in Roman and rings in ordinary figures. *mt.h.*, mouth-opening; *pr.b.*, proboscis; *sal.g.*, salivary glands; *ej.c.*, ejaculatory canal; *tp.*, terminal portion of ejaculatory canal; *vas.d.*, vas deferens; *t. 1, t. 6*, first and sixth pairs of testes; *ov.*, ovary (shown on one side only for the sake of clearness); *cr. 1, cr. 6*, first and sixth pairs of cæca of the crop; *st.*, stomach; *int.*, intestine; *an.*, anus.

PLATE XII.

Placobdella undulata, sp. n. Diagram showing external features, reproductive system, alimentary tract, and nerve-ganglia. Somites numbered in Roman and rings in ordinary figures. *mt.h.*, mouth; *pr.b.*, proboscis; *sal.g.*, salivary glands; *cr. 1, cr. 7*, first and seventh pairs of crop-cæca; *st.*, stomach; *int.*, intestine; *an.*, anus; *ej.c.*, ejaculatory canal (shown only on one side for the sake of clearness); *tp.*, terminal portion of ejaculatory canal; *v.d.*, vas deferens; *t. 1, t. 6*, first and sixth pair of testes; *ov.*, one of the ovaries; *a.g.m.*, anterior ganglionic (circumoesophageal) mass; *p.g.m.*, posterior ganglionic mass; *gang.*, a ganglion of the ventral chain.

PLATE XIII.

Placobdella fulva, sp. n. Diagram showing external features, digestive tract, and nerve-ganglia. Somites numbered in Roman and rings in ordinary figures. *i.p.*, intermediate papilla; *m.p.*, marginal papilla; *mth.*, mouth; *pr.s.*, proboscis sheath; *cr.*, crop; *st.*, stomach; *int.*, intestine; *an.*, anus; *gn.*, ganglion of the ventral chain.

PLATE XIV.

Paraclepsis prædatrix, sp. n. Diagram showing external features, reproductive system, alimentary tract, and ventral nerve-ganglia. Some of the paired organs are shown on one side only, in order to obtain clearness. Somites numbered in Roman and rings in ordinary figures. *mth.*, mouth-opening; *prb.*, proboscis; *sal.g.*, salivary glands; *cr.*, crop; *st.*, stomach; *int.*, intestine; *an.*, anus; *ej.c.*, ejaculatory canal; *t.p.*, terminal portion of the same; *ves.sem.*, vesicula seminalis; *vas.def.*, vas deferens; *te. 1*, *te. 5*, first and fifth pairs of testes; *a.g.m.*, anterior ganglionic mass; *p.g.m.*, posterior ganglionic mass; *gang.*, a ganglion of the ventral chain.

PLATE XV.

Paraclepsis vulnifera, sp. n. Diagram showing external features, reproductive system, and alimentary tract. Somites numbered in Roman and rings in ordinary figures. *mth.*, mouth-opening; *prb.*, proboscis; *sal.g.*, salivary glands; *cr.*, crop; *st.*, stomach; *int.*, intestine; *an.*, anus; *ej.c.*, ejaculatory canal; *t.p.*, terminal portion of ejaculatory canal; *vas.d.*, vas deferens; *ov.*, ovary (one ovary only is shown, for the sake of clearness); *gang.*, a ganglion of the ventral chain.

L.—On a new *Asterias* from Chile.

By EMILIE GOLDSCHMIDT.

In the collection of the "Zoologisch Museum" of Amsterdam I found a large, not yet described, *Asterias*, collected by Captain Terwiel off the coast of Chile.

The description of this single specimen, preserved in spirit, and which I propose to call *Asterias* (*Smilasterias*) *terwielii*, is as follows:—

Five arms. $R=222$ mm.; $r=38$ mm.; $R:r=5, 8$.

Breadth of arm at base = 42 mm.

Arms flattened, tapering gradually, rather narrow at the end (compare fig. 1). Disk flattened, even somewhat depressed.

The armature of the adambulacral plates (compare fig. 2) consists of three spines, closely placed at the base, radiating apart; the inner, the thinnest, is extending into the ambulacral groove and is slightly turned upward. The spines are truncate at the tip, the outer somewhat compressed in a sense perpendicular to the groove (the long side of the

spine being parallel with it), with a dark colouring near the tip. At both sides of these spines may be found some small and fine spinelets.

Fig. 1.

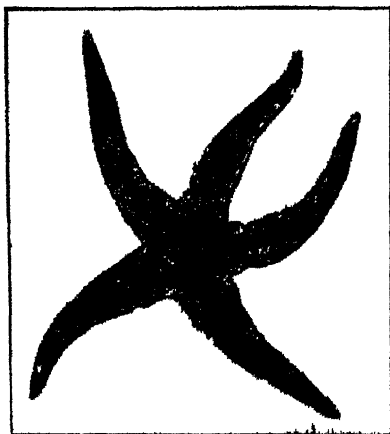
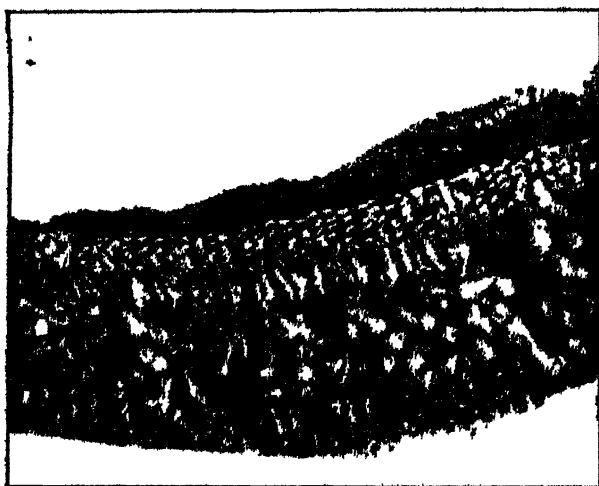
Abactinal aspect. $\frac{1}{2}$ nat. size.

Fig. 2.



Portion of actinal side of arm. About nat. size.

Immediately external to the adambulacral plates follows another series of plates, each plate bearing 4 or 5 spines. These spines form one transverse row with those of the

adjacent adambulacral plate, but they are stouter, broader, more compressed, with a darker colouring near the tip, truncate, and having a slightly marked groove along the outer (aboral) side. Outward they become shorter and broader still, the outer spine(s) is (are) short and very broad, spoon-shaped, darkly coloured at the concave (aboral) side. These spines, too, are accompanied by rather small spinelets, which may surround each spine separately and are very closely placed around the aboral side of the outer spine(s), so as to form a kind of paxilla.

This series of plates is separated from the next by a rather narrow row of papulæ.

Then follows another series of plates, each plate bearing a paxilla.

On the arm-sides the paxillæ are arranged in regular rows,

Fig. 3.



Portion of abactinal side of arm. About nat. size.

alternating with the papular rows, the plates forming a regular network, in the meshes of which the papular areas are to be found. Of these series the first (about 5 or 6), beginning at the angle of the arms, do not reach the arm-end (the ventro-lateral series?); they are followed by some (2 to 4) complete series (the dorso-lateral ones), which, however, become indistinct at the arm-tip. On the middle of the arms (compare fig. 3) and on the disk the arrangement of the network is irregular and the papular areas are but small. On the middle of the disk they are still more reduced, the paxillæ being very closely placed. Consequently the madreporic body is not conspicuous.

All skeleton-parts—the paxillæ, as well as the plates—are covered by a thin brownish-black epithelial membrane. As a rule, it does not cover the papular areas, this being due

perhaps to a contraction of the membrane in preserved state.

The number of the spinelets forming a paxilla varies mostly from 10 to 15, on the middle of the arms and on the disk it may even surpass 40; the outer are somewhat flattened, one or more of the inner are much stouter and a little longer than the others, and ending in a blunt, slightly rounded tip. Pedicellariæ were not to be found.

As to the ambulacral feet they are yellow-coloured and very long.

Except for the feet, the adambulacral armature, and the papular areas, the colour of the animal is brownish black.

As to the relation with other Asteriidæ it seems to me that, at least with regard to the adambulacral armature, there is a resemblance with the subgenus *Smilasterias*. Sladen gives the definition: "Armature of the adambulacral and infero-marginal plates consisting of flattened spines, forming transversely or obliquely placed combs." But comparing his figures of the spines in two species of *Smilasterias* ('Challenger,' plate C ii. fig. 6 and plate C iii. fig. 2), it strikes at once that the flattening of the spines is just in the other sense there than it is by *Asterias terwielii*, the long side of the spines being perpendicular to the groove there, while it is parallel with it here. Lastly, I do not think there are important points of resemblance with any other subgenus of the genus *Asterias*.

Amsterdam, July 1924.

LI.—*Descriptions of Two new Species of the Genus Nygmia*
(Liparidæ) from East Africa. By W. H. T. TAMS.

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Nygmia sericaria, sp. n.

♂. Palpi not longer than the diameter of the eyes; first segment not longer than broad, second segment slightly longer and stouter than third, the second and third together 1 mm. long; colour orange (III.), the third segment with some lighter scales. Antennæ with shaft cream-coloured (XVI.), pectinations clay-coloured (XXIX.). Head with vertex cream-coloured, frons light orange-yellow (III.), deeper at sides, eyes surrounded by orange hair-scales, and below the palpi a distinct beard, orange in front, lighter below and behind. Thorax cream-colour and ivory-yellow (XXX.)

mixed, abdomen above ivory-yellow; pectus and underside of abdomen ivory-yellow, the anal tuft enriched to Naples yellow (xvi.). Fore legs with the coxæ orange in front; femora ivory-yellow shaded inwardly with light orange-yellow; tibiæ light orange-yellow shaded inwardly with orange, distally white, outwardly the long hair light orange-yellow to ivory-yellow, with long ivory-yellow to white hair behind; tarsi cream-coloured, paler behind. Mid and hind legs with less long hair and with much less orange shading. Fore wings almost white, glossy, with the costa, veins, and fringe cream. A rounded orange-rufous (ii.) spot at the end of the cell and four orange-rufous spots subterminally, 3 mm. from margin of fringe, of which one, very small, lies between veins *R* 4 and *R* 5, a larger one between veins *R* 5 and *M* 1, and two somewhat larger, roughly wedge-shaped, closely approximated spots lie near the tornus, one on each side of the anal vein. Hind wings like fore wings, but with lighter fringe and without spots. Underside of wings like upper-side, fore wings without spots.

Expanse 42 mm.

♀. Like male, but with a large compact anal tuft of cinnamon-brown (xv.) hair-scales.

Expanse 50 mm.

Holotype ♂ and allotype ♀: Kenya Colony, Nairobi (*T. J. Anderson*), 1924. Paratypes: 7 ♂ ♂ and a ♀, of like origin.

The holotype, allotype, and five paratypes, in all five ♂ ♂ and 2 ♀ ♀, have been generously presented to the British Museum by Mr. T. J. Anderson, Government Entomologist, Kenya Colony, through the Imperial Bureau of Entomology.

The larvae of the moth make nests of silk on the native trees at Nairobi, but no investigation into the nature and quality of this silk has yet been made.

Nygmia neavei, sp. n.

♂. Palpi very short, being (denuded) only $\frac{3}{4}$ mm. long; colour of scales light orange-yellow (iii.) at base to orange (ii.) at tip. Antennæ with the shaft whitish tinged with cartridge-buff (xxx.), the pectinations clay-coloured (xxix.). Head with vertex whitish, frons cream-coloured (xvi.), in the middle tinged laterally with light orange-yellow (iii.). Thorax, pectus, and abdomen ivory-yellow or cartridge-buff (xxx.), sometimes with deeper tints (cream-colour) at the sides of the abdomen and in the anal tuft. Fore legs with the coxæ whitish behind, light orange-yellow to orange in front; femora whitish, tinged on inner side with light orange-yellow; tibiæ whitish behind, in front light orange-yellow strongly shaded with orange on inner side; tarsi

whitish and light orange-yellow mixed. Mid and hind legs whitish to ivory-yellow, with only slight tinting of light orange-yellow. Fore wings almost white, glossy, with the costa near the base tinged with light orange-yellow, and with a faint tinge of cartridge-buff or ivory-yellow along the costa, on the veins, and at the base and termen of the wings. At the end of the cell there is an orange-rufous (II.) spot, and there is a subterminal series of seven interneural orange-rufous spots—four above vein *M*3 and three below vein *Cu* 1—there being no spot between these two veins. The spot between veins *R* 5 and *M* 1 is often small, and occasionally only represented by a few scales. Sometimes a few light orange-yellow to orange-rufous scales occur amongst the fringe of the inner margin postmedially or subterminally. Hind wings glossy, almost white, with the veins, termen, and inner margin tinged with cartridge-buff or ivory-yellow. Underside of both wings glossy, almost white, tinted as on upperside, and with a strong shading of light orange-yellow at base of costa of fore wings; no spots.

Expanse 36–40 mm.

♀. Like male, but white, with only the faintest traces of the light orange-yellow colouring round the mouth-parts, fore legs, and underside of base of costa of fore wings. Anal tuft sepia (XXIX.).

Expanse 38–43 mm.

Holotype ♂ and allotype ♀: Nyasaland, Mlanje Plateau, 6500 feet, November 11th, 1913 (*S. A. Newe*).

Paratypes: 23 ♂♂ and 11 ♀♀ from the same source, with dates varying from November 10th to 13th, 1913; another ♀ from the same collection, labelled December 17th, 1913; and 1 ♀ from N.W. Rhodesia, Solwezi, January 1918 (*H. C. Dollman*).

The numbers in brackets (II. etc.) refer to the plates of colours in Ridgway's 'Color Standards and Color Nomenclature,' 1912.

LII.—On a new Ammonite (*Engonoceras iris*, *sp. n.*) from the Gault of Folkestone. By L. F. SPATH, D.Sc., F.G.S.

WHILE collecting in the Gault of Folkestone this summer, the writer was fortunate in finding an ammonite which belongs to a family (*Engonoceratidae*) hitherto believed to be absent from the Cretaceous strata of this country. The genus *Engonoceras*, in fact, is typically American, and only a few isolated examples of related genera are known from

the Old World. The new ammonite, therefore, is important for correlating American Albian deposits with the type-succession of the English Gault, and it seems desirable to give a preliminary account of this discovery of the only known British Pseudoceratite.

The specimen was found on those clay-reefs on the foreshore of East Wear Bay, below the Warren, that Price* had referred to as "faulted in great confusion, many of the beds being mixed up together." In the writer's "Report of an Excursion to Folkestone"† it was mentioned that these reefs afforded excellent opportunity for collecting to those familiar with the succession in the cliffs, and for some time now, partly with the help of grants from the Royal Society, I have searched the beds between tides with the view of accumulating unequivocal material for description in my 'Monograph of the Gault Ammonoidea' (Palæontographical Society). As an indication of the rarity of some of the Gault ammonites it may incidentally be mentioned that, while occasionally coming across new species, I have not yet been able to find, even loose, a single example of a *Phylloceras* or a *Desmoceras*—genera described in the first part of the Monograph.

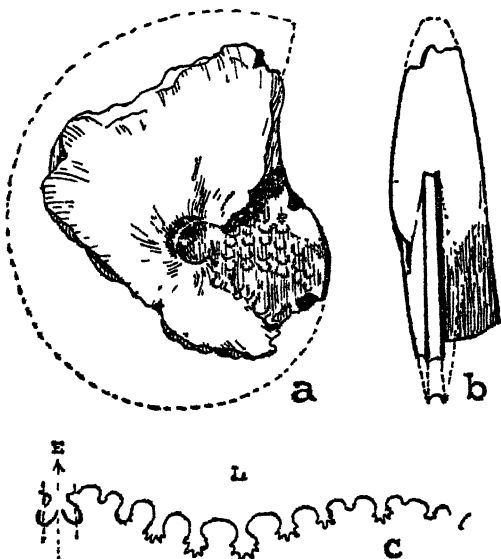
The ammonite here discussed was found loose on clays of the lower *cornutus*-zone (beds V.-VI. of Price) with the *delaruei*-zone (bed IV.) following conformably on one side, whereas on the other a mass of the rather barren clays of Price's bed III. abruptly cut off the succession. The comparatively rare ammonites of this "crab-bed" (to be separated as a *niobe*-zone from the *intermedius*-zone below, when its distinctive form is described) resemble the new species in being very fragile; but so are the far commoner fossils of the earlier part of the *delaruei*-zone and those of the lower *cornutus*-zone. From the mode of preservation it seems probable, therefore, that the new ammonite belongs to the bed (lower *cornutus*-zone) on which it was found, and, in any case, it can safely be described as of Middle Lower Gault (Anahoplitan) age.

Pending a detailed description of the new form in one of the future parts of the Gault Monograph, it may briefly be stated that at a diameter of about 55 mm. the (fragmentary) specimen is completely septate, and it was thus originally of considerable dimensions. The periphery is narrowly bicarinate and distinctly concave, at least on the earlier whorl.

* "Gault of Folkestone," Quart. Journ. Geol. Soc. vol. xxx. p. 342 (1874).

† Proc. Geol. Assoc. vol. xxiv. p. 70 (1923).

The sides are flat and the test is ornamented merely with faint, first prorsi-, then rursi-radiate lines of growth that tend to unite in bundles near the umbilicus, without, however, forming definite nodes. In periphery and flat sides the new ammonite thus resembles *Protengonoceras galbi* (Boehm), Hyatt*, but in suture-line it is closer to *Engonoceras* (type: *E. pierdenale*, v. Buch sp., in Hyatt) or to *Metengonoceras* (type: *M. inscriptum*, Hyatt†), though the latter genus differs in sharpening of the venter. Apart from *Engonoceras* (*Protengonoceras*?) *pedernale* (v. Buch), emend. Boehm‡, §



Engonoceras iris, sp. n. Lower Gault of Folkestone (probably lower *cornutus*-zone).

a, b, side and peripheral views of fragmentary holotype, somewhat diagrammatic; c, external suture-line ($\times 3.5$). E=external lobe; L [= L(l_1 , l_2 , l_3)?] = lateral lobe?; A₁₋₃ and U_{1-n}? not determined.

non Hyatt, with closely similar suture-line, *Engonoceras gibbosum*, Hyatt§, and especially *E. uddeni* (Cragin), Hyatt||, may be mentioned as comparable species. *Engonoceras*

* "Pseudoceratites of the Cretaceous," Monogr. U.S. Geol. Surv. vol. xlv. p. 163, pl. xvii. figs. 16-20 (1903).

† *Ibid.* p. 180, pl. xxvi. figs. 1-3 (lectotype).

‡ "Über *Ammonites Pedernalis*, v. Buch," Zeitschr. Deutsch. Geol. Ges. vol. I. pp. 183-4, pl. v. figs. 1, 2 (1898).

§ *Loc. cit.* p. 171, pl. xxii. figs. 6-8 only (1903).

|| "Pseudoceratites of the Cretaceous," Monogr. U.S. Geol. Surv. vol. xlv. p. 159, pl. xix. figs. 1-6 (1903).

thomasi, Pervinquierè*, with equally smooth and flat sides, differs in suture-line and wider ventral area, and was recorded from the Cenomanian of Tunis.

As *Pseudoceratites* are commonly supposed to illustrate the decline of a weakened ammonite tribe and its return to a "primitive" condition, it ought to be pointed out that the numerous elements of the suture-line of *Engonoceras* recall the acme of ammonite specialization in the Trias. The new form here described in this respect resembles *Indoceras baluchistanense*, Noetling, the youngest of all ammonite genera, with seventy-five lobes and saddles in its suture-line and showing no geratologous characters†. It may also be mentioned here that Salfeld‡ considered *Engonoceras* to be a direct offshoot of the primitive radical *Phylloceras*, though the writer has shown that a similarly "lituid" internal lobe in, e. g., *Hysterocheras binum* (Sowerby), var. §, or *Psilophyllites hagenowi* (Dunker) ||, may result from reduction of an originally fairly complex element.

Correlation of American deposits with the European Albian is still very uncertain, and the ages of the *Engonoceras*-bearing strata are not definitely known. The typical European Gault successions are characterized by ammonite faunas with a profusion of *Hoplites* or forms at one time considered to be "boreal" types, whereas with regard to the dominant ammonites of the warmer seas the writer ¶ stated only last year:—"Hypengonoceras, like the earlier *Engonoceras* and other *Pseudoceratites*, or like the persistent radical stocks *Phylloceratidæ* and *Lytoceratidæ*, in general did not penetrate into the areas of temporary transgressions where the rapidly modifying [*i. e.*, trachyostracous] derivatives of these two 'stenothermal' families enormously increase." As in other cases in which difference of ammonite faunas is due merely to difference of province and not to difference in date of existence, there are ammonites common to the two regions—namely, *Dipoloceratidæ*, with almost world-wide

* "Études de Paléontologie Tunisienne.—I. Céphalopodes des Terrains Secondaires," Carte Géol. Tunisie, p. 202, pl. ix. figs. 6 a, b, text-fig. 77 (1907).

† See Spath, L. F., "Notes on Ammonites," Geol. Mag. p. 33 (1910).

‡ "Über die Ausgestaltung der Lobenlinie bei Jura- und Kreide-Ammonoideen," Nachr. K. Ges. Wiss. Göttingen, Math. Phys. Kl. p. 8 (1919).

§ See Spath, L. F., "Monograph of the Ammonoidea of the Gault," Pal. Soc. vol. for 1921, p. 10, text-fig. 1 h (1923).

|| Spath, L. F., "The Ammonites of the Blue Lias," Proc. Geol. Assoc. vol. xxxv. text-fig. 12 (1924).

¶ "On the Ammonite Horizons of the Gault and Contiguous Deposits."—Appendix II. Summary of Progress for 1922, Mem. Geol. Surv. p. 145 (1923).

distribution, and Lyelliceratidæ. Thus, "*Engonoceras* cf. *pedernale* (v. Buch), Hyatt," recorded by Böse* from Mexican beds with *Oxytropidoceras chihuahuense*, cannot be of Vraconnian age as claimed by that author, but is probably of Lower Gault (*delaruei*) age. *Engonoceras stolleyi* (Boehm), quoted by Böse from the same beds, is close to several species of *Engonoceras* recorded by Hyatt from the Comanche Series of the Fredericksburg Group, and *E. gibbosum*, Hyatt, from the Goodland Limestone, may be of slightly earlier age (*dentatus-intermedius*-zones), to judge by the associated *Oxytropidoceras*. Still earlier Albian species of *Engonoceras* have been recorded from the Walnut Series of the Fredericksburg Division.

On the other hand, Upper Albian forms of *Engonoceras* occur in the Duck Creek Marls (*orbigny*-zone?), the Denton (*æquatorialis*?), Weno, and Pawpaw Divisions (*studeridispar*-zones), all regarded as Cenomanian by Adkins†. Many of these *Engonoceras*, however, have not yet been studied in sufficient detail, so that it is impossible to state whether the Lower Cenomanian *Engonoceras* from the Grayson Formation, recorded by Adkins and Winton‡, and the Lower Gault forms here discussed really belong to one genus.

The Lower Gault *Amaltheus ebrayi*, de Loriol§, with a suture-line far less ceratitic than the suture-lines of *Engonoceras*, *Protengonoceras*, and *Metengonoceras*, and different from that of *Hypengonoceras*, will have to be separated as a new genus—*PARENGONOCERAS*, gen. nov.,—and *Sphenodiscus* cf. *pedernalis* (v. Buch), Grossouvre||, from the Upper Cenomanian of Sainte Croix, near Le Mans, probably belongs to *EPENGONOCERAS*, gen. nov., proposed for Hyatt's "*Metengonoceras*" from the Eagle Ford Shales¶.

It thus appears that *Engonoceras iris* is the only European species of this genus, and that Grossouvre's Upper Cenomanian and de Loriol's Middle Albian forms are the only other European members of the family Engonoceratidæ.

* "Monografía Geológica y Paleontológica del Cerro de Muleros," Bol. Inst. Geol. Mexico, no. 25, p. 82, pl. xi. figs. 1-3 (1910).

† "The Weno and Pawpaw Formations of the Texas Comanchean," Univ. Texas Bulletin, no. 1856, p. 10 (1918).

‡ "Paleontological Correlation of the Fredericksburg and Washita Formations in North Texas," Univ. Texas Bulletin, no. 1945, p. 81 (1919).

§ "Études sur la Faune des Couches du Gault de Cosne (Nièvre)," Mém. Soc. Pal. Suisse, vol. ix. p. 7, pl. i. (1882).

|| "Ammonites de la Craie Supérieure," Rech. Craie Supér. ii., Pal., Mém. Carte Géol. Dét. France, p. 140, text-fig. 58 (1898).

¶ Hyatt, *loc. cit.* pp. 184-7 (1903); type to be *E. dumblis* (Cragin), Hyatt, p. 185, pl. xxvii. figs. 8-14. See also Spath, "Cretaceous Ammonoides from Angola," Trans. Roy. Soc. Edinburgh, vol. liii. pt. i. no. 6, p. 112 (1922).

LIII.—On a new Species of *Crocidura* from Scilly.

By MARTIN A. C. HINTON.

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MR. W. N. BLAIR has very kindly presented to the British Museum a small shrew which he was fortunate enough to capture upon an uninhabited island during a recent visit to Scilly. This specimen turns out to be of unusual interest, representing, as it does, a new species of *Crocidura*, a genus not hitherto known to exist in the British Isles. During the last twenty-five years I have studied a very large number of fossil shrews obtained from many parts of Britain and from many different deposits, ranging in time between the late Pliocene (Cromerian) and the Holocene. Large collections of recent shrews obtained from various parts of the mainland of Britain, Ireland, and from many of the smaller islands around our coasts have also been studied. Without exception all this material, fossil and recent, belongs to the brown-toothed genera *Sorex* and *Neomys*.

White-toothed shrews of the genus *Crocidura* have, of course, a wide distribution throughout Africa and the warmer portions of Europe and Asia. Eastwards they range to the Malay Archipelago, while westwards they reach the Atlantic coast of Europe, the Channel Islands, and, as Mr. Blair's discovery now shows, the Scillys. It is interesting to note that while the species inhabiting the Channel Islands (Alderney and Guernsey) is apparently indistinguishable from *C. russula*, a widely distributed species in Central and Southern Europe, that now obtained from Scilly is more nearly related to the two other continental species *C. leucodon* and *C. mimula*, although it cannot be identified with either.

Crocidura cassiteridum, sp. n.

A dark-coloured species with skull and teeth essentially as in *C. leucodon* and *C. mimula*.

Size medium (hind foot 11.5 mm. ; condylo-basal length of skull 17).

Fur soft and full. General colour (specimen in spirit) dark grey above, passing insensibly into a paler ashy grey below. Ears concolorous with head and back. Hands and feet each with six pads as usual, whitish grey above. Tail indistinctly bicoloured, brownish grey above, whitish grey below ; clad with short stiff hairs which do not completely conceal the annulations, and furnished throughout with a fair number of scattered longer hairs.

Skull most closely resembling that of *C. mimula*, though

slightly longer and narrower; outer wall of anteorbital canal similarly narrow and brain-case similarly flattened in both species. Dentition consisting of the twenty-eight completely white teeth characteristic of the genus; the individual teeth agreeing with those of *C. leucodon* and *C. mimula* in general form. Of the three upper unicuspid teeth the anterior is the largest and the second the smallest, as in the related species. The posterior unicuspid is distinctly larger than the second and its crown is taller than in either *mimula* or *leucodon*, its point overtopping that of the anterior basal cusp of p^1 and rising distinctly above a line connecting the latter cusp with the summit of the basal lobe of the first incisor. Mandible and mandibular teeth without special peculiarities, the anterior small tooth, or canine, long and low-crowned as in *C. leucodon*.

Dimensions of type (measured after a short immersion in spirit):—Head and body 58 mm.; tail 33; hind foot 11.5; ear from meatus 7.

Skull-measurements:—Condylar-basal length 17 mm.; condylar-incisive length 18; zygomatic breadth 6; lachrymal breadth 4.3; breadth of brain-case 8.5; depth of brain-case (median) 4.7; maxillary tooth-row (entire) 7.9. Mandible 9.4; mandibular tooth-row (entire) 7.1.

Type. Adult male (teeth moderately worn) in spirit. B.M. no. 24. 8. 12. 1. Collected in the Scilly Isles in August 1924, and presented to the British Museum by Mr. W. N. Blair.

Hab. Scilly Isles.

Blair's white-toothed shrew presents us with an interesting combination of the characters found in the two related continental species, *C. leucodon* and *C. mimula*. In size and skull-structure it resembles the latter species, while in the colour of its back and in the form of the lower canine it agrees with the former. It lacks, however, the strongly marked bicoloration of *leucodon*, and its tall-crowned posterior upper unicuspid tooth is peculiar.

Apart from *Rattus rattus*, *R. norvegicus*, and *Mus musculus*, the three species introduced by human commerce, only four small mammals have hitherto been known to exist upon the Scillys. These are two bats (*Pipistrellus pipistrellus* and *Plecotus auritus*), the long-tailed field-mouse (*Apodemus sylvaticus*), and the pygmy shrew (*Sorex minutus*) recorded by Chubb. In the light of Mr. Blair's discovery, the latter record now requires confirmation. It is to be hoped that the islands will be carefully searched for small mammals. They ought to harbour a vole, and if one is found it should prove to be of considerable interest.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

May 21st, 1924.—Dr. J. W. Evans, C.B.E., F.R.S.,
President, in the Chair.

Mr. CARL ADOLPH SUSSMILCH, F.G.S., delivered a lecture on the Geological History of South-Eastern Australia, with special reference to the Carboniferous and Permian Periods. The Lecturer pointed out that rocks of definite Archæozoic age occur only over a limited area in the western part of the State; they contain the important silver-lead-zinc ore-deposits of the Broken Hill District. Proterozoic strata are limited also to the same area; these contain glacial tillites which have usually in the past been considered Cambrian, but they are probably of pre-Cambrian age. No undoubted Cambrian strata are known to occur in New South Wales.

Ordovician strata are very extensively developed, both in New South Wales and in Victoria: they consist mainly of claystones with some fine-grained sandstones, and contain an abundant graptolite-fauna. Both Lower and Upper Ordovician strata are found in Victoria, but so far only the latter have been identified in New South Wales.

Silurian strata are developed over extensive areas in New South Wales, particularly in the southern and central parts of the State, and extend also through the centre of Victoria; in addition to claystones, there is a considerable development of limestones, individual beds ranging up to 550 feet in thickness. An abundant coralline fauna is preserved in these limestones, and there are also many brachiopods and hydrozoa.

The sea appears to have retreated from the land at the close of the Silurian Period in South-Eastern Australia, but renewed transgressions of limited extent took place early in the Devonian Period. The sedimentation which took place in these areas in Lower and Middle Devonian times was accompanied by very extensive deposition of lavas and tuffs, this being one of the important volcanic epochs of South-Eastern Australia. Thick coralline limestones were also deposited during that age. Important crustal movements took place at the close of Middle Devonian times, followed by an extensive transgression of the sea in New South Wales in the Upper Devonian Period, a transgression which extended from the present south-eastern coast almost to the far western boundaries of the State. In the strata deposited in this epicontinental sea an abundant brachiopod fauna is preserved, as also numerous fish-remains. Important crustal movements took place at the end of the Devonian Period, which brought about a complete withdrawal of the sea; much of South-Eastern Australia has not since been beneath the sea.

Early in the Carboniferous Period a geosyncline developed in North-Eastern New South Wales, and in this was first deposited a series of marine strata in the latter part of Lower Carboniferous times. Following a withdrawal of the sea, an extensive series of terrestrial beds was deposited in this area in Middle and Upper Carboniferous times; these terrestrial strata consist mainly of conglomerates, volcanic rocks (lavas and tuffs), and glacial beds, of an aggregate thickness approaching 10,000 feet. The glacial beds are of such a thickness and volume as to imply intense and long-continued glaciation. Associated with these deposits is a characteristic *Rhacopteris* fossil flora.

In Permian (Permian-Carboniferous) time an alternating series of marine and freshwater beds was deposited in the north-eastern part of New South Wales, and these extend far northwards into Eastern Queensland. The freshwater beds contain the most productive coal-measures of Australia, and associated with the coal-seams is the characteristic *Glossopteris* flora. The glacial conditions of the Carboniferous Period continued also far into the Permian Period, but with apparently reduced intensity. The Permian Period closed in North-Eastern New South Wales and South-Eastern Queensland with pronounced orogenic movements, accompanied by granitic intrusions; but elsewhere in New South Wales, and throughout Victoria and Tasmania, no earth-folding took place at that time.

In the Trias-Jura Period the whole of Eastern Australia stood above the sea, and extended far east of the present shore-line. Upon this land there developed a number of large lake-basins, in which several thousands of feet of freshwater strata were deposited; and in some areas productive coal-measures were formed.

In the Cretaceous Period a transgression of the sea began in the north, and extended southwards over Central Queensland into Northern New South Wales, and well into Central Australia. At the beginning of the Tertiary Era a tilting of the Australian continent on an east-and-west axis caused the Cretaceous sea to retreat northwards, and allowed of transgression taking place over considerable areas in the south, incidentally separating Tasmania from the mainland.

The close of the Tertiary Era was marked by a great epeirogenic uplift in Eastern Australia, which produced the existing tablelands that trend parallel to the eastern coast of Australia. The elevation of these tablelands was accompanied by extensive block-faulting. During the Pleistocene Period limited high areas in New South Wales and Tasmania supported glaciers and ice-sheets; more recently, a subsidence of the land (or raising of the sea-level) drowned the shore-line to an extent of about 200 feet, and still later an upward movement of the strand-line of some 10 to 20 feet has taken place.

THE ANNALS
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NINTH SERIES.]

No. 83. NOVEMBER 1924.

LIV.—*Erotic* Muscaridæ (*Diptera*).—XIV.* By J. R. MALLOCH, Bureau of Biological Survey, Washington, D.C.

Subfamily ANTHOMYIINÆ.

Genus PYCNOGLOSSA, Coquillett.

This genus was erected in 1901 for the reception of one species—*flavipennis*, Coq.—described from a female specimen taken in the State of Washington, U.S.A. The genus was placed by its describer in the family Scatophagidæ, but I have lately examined the type-specimen of the genotype, and find that it is an Anthomyid and that the genus is synonymous with *Pogonomyza*, S. & D., which it antedates by several years, thus causing the latter to fall as a synonym.

There are two European species referable to the genus—*flavipennis*, Fallén, and *cinerosa*, Zetterstedt. Both of these species are recorded from North America. I have recorded *flavipennis*, Fallén, and described two other species—*spinovissima* and *proboscidalis*. It is possible that the last-named is identical with *cinerosa* and that *flavipennis*, Coquillett, is also a synonym. In any case, the latter is a homonym and cannot be maintained, so that for the time being the North-American species may be called *proboscidalis*—the more so

* For Part XIII., see Ann. & Mag. Nat. Hist. (9) xiv., September 1924, pp. 257-274.

as there are several very closely allied forms which are evidently undescribed, and the elucidation of the specific identities must await the acquisition of more material in the genus.

Hydrophoria packardi, sp. n.

Male.—Black, distinctly shining. Ocelli, parafacials, and cheeks whitish pruinose. Abdomen with grey pruinescence, the dorso-central vitta narrow, of uniform width. Wings hyaline, yellowish basally. Calyptæ pale-fringed. Halteres brownish yellow.

Narrowest part of frons a little wider than distance across posterior ocelli, orbits finely bristled to above middle; parafacial at base of antennæ wider than third antennal segment, not narrowed below; cheek higher than widest part of parafacial, the upwardly curved anterior setulose hairs weak and sparse; arista with its longest hairs a little longer than its basal diameter. Presutural acrostichals irregular, but none conspicuously elongated; prealar about one-third as long as the bristle behind it; hypopleura with a few hairs above in front of spiracle. Abdomen short and stout, tergites subequal, their posterior lateral angles rather densely bristled, sixth (fifth visible) glossy, very slightly pruinose above in centre and with numerous setulose hairs; basal portion of hypopygium (seventh tergite) densely covered with short setulose hairs, which are curved slightly upward; fifth sternite with the processes short, rounded apically, finely haired, their basal halves on inner margins with dense stiff hairs. Fore tibia with two or three antero-dorsal and one posterior bristle; mid-femur on basal half of antero-ventral and postero-ventral surfaces with a number of long bristles; mid-tibia with three or more antero-ventral bristles in addition to those on antero-dorsal and posterior surfaces; hind femur with long strong bristles on entire length of antero-ventral surface and weaker bristles on basal two-thirds of postero-ventral surface; hind tibia with four or more antero-ventral and antero-dorsal and three or four postero-dorsal bristles.

Length 6 mm.

Type, Caribou Island, Labrador (*Packard*).

Named in honour of the collector.

This species runs down to *occidentalis*, Malloch, in my key to the species of this genus published in the 'Canadian Entomologist' in 1920, p. 253. It differs from it in the structure of the head, armature of the abdomen and mid-tibia, and in having the arista very much shorter-haired.

Genus FALLACIA, Stein.

This genus was erected for the reception of a single species—*limnophora*, Stein,—described from Formosa. Stein afterwards placed the species in the genus *Calythea*, and, misled by his action, I redescribed the genus and species in Part I. of this series of papers under the name *Myiographa fascigera*, from Siam.

The prosternum is bare, not setulose on sides as in *Calythea*; the hypopleura is also bare, and the sixth wing-vein is not traceable to the wing-margin as in *Calythea*. The species is known to me from Formosa, Siam, and the Philippine Islands.

This is one of the very few species in the subfamily in which the sixth vein is not distinctly traceable to the margin of the wing; but the presence of fine hairs on ventral surface of the scutellum, and a bristle at base of hind metatarsus on the ventral surface, as well as the similarity of habitus and thoracic and tibial armature to those of *Calythea*, indicate unmistakably its affinities.

Subfamily FANNINÆ.

In Part XII. of this series of papers I presented a key to the males of the Nearctic species of the genus *Fannia*, R.-D. I now submit a key to the females of the species of this genus from the same region, in the hope that it may prove useful to students of the group.

The species which occur in Europe and North America are marked with an asterisk.

Key to Females of Nearctic Species of Fannia.

- | | |
|--|-----------------------------|
| 1. Legs with at least the hind tibia or femora translucent yellowish | 2. |
| Legs entirely black, or only the bases of tibia yellowish | 10. |
| 2. Scutellum partly yellowish | * <i>pretiosa</i> , Meigen. |
| Scutellum entirely black | 3. |
| 3. Coxæ and femora brown or fuscous; mid-tibia with two antero-dorsal, two postero-dorsal, and two postero-ventral bristles; hind tibia with two or three antero-dorsal bristles | <i>fuscitibia</i> , Stein. |
| Tibia not darker than femora; mid and hind tibia not bristled as above | 4. |
| 4. Hind tibia without setula basad of the antero-dorsal bristle; femora yellow | 5. |
| Hind tibia with several setulae basad of the antero-dorsal bristle; femora black | 9. |

5. Abdomen with three series of blackish spots on dorsum; palpi and bases of antennæ yellowish; a series of minute setulæ descending well below apex of second antennal segments on parafacials *benjamini*, Malloch.
 Abdomen with at most a dark dorso-central vitta or one series of spots; no setulæ on parafacials below bases of antennæ 6.
6. Fore tibia with a postero-dorsal bristle .. **ornata*, Meigen.
 Fore tibia without a postero-dorsal bristle 7.
7. Hind coxæ with one or two hairs at apices above base of hind femora; hind tibia with three or four antero-ventral bristles; prealar short, duplicated; antennæ black, apex of second segment reddish *pallidiventris*, Malloch.
 Hind coxæ bare at apices above 8.
8. Antennæ black, third segment reddish yellow; arista distinctly pubescent; prealar bristle absent; hind tibia with four antero-ventral bristles *curvipes*, Malloch.
 Antennæ entirely black; arista pubescent; prealar present, not duplicated; hind tibia with a bristle near middle and another near apex on antero-ventral surface *ochrogaster*, Thomson.
9. Abdomen entirely black **fuscata*, Fallén.
 Abdomen largely or entirely yellowish .. *pellucida*, Stein.
10. Mid-tibia with one or more antero-ventral or ventral bristles 11.
 Mid-tibia without antero-ventral or ventral bristles 13.
11. Frontal orbits highly polished, without grey pruinescence, either orbit much wider than the very narrow interfrontalia **carbonaria*, Meigen.
 Frontal orbits largely or entirely grey pruinosecent 12.
12. Mid-tibia with more than one antero-dorsal bristle; legs black **polychaeta*, Stein.
 Mid-tibia with only one antero-dorsal bristle; bases of tibiae broadly yellowish. **gynualis*, Stein.
13. Palpi very small, slightly swollen at apices and with several fine hairs; both mid and hind tibiae with more than one strong antero-ventral bristle **minutipalpis*, Stein.
 Palpi not very small, and not as above in other respects 14.
11. Mid-tibia with more than one antero-dorsal bristle in addition to the apical one 15.
 Mid-tibia with only one antero-dorsal bristle in addition to the apical one 16.
15. Hind tibia with one antero-ventral bristle. **kowarzi*, Verrall.
 Hind tibia with three or four antero-ventral bristles **armata*, Meigen.
16. Orbital setulæ descending on parafacials considerably below bases of antennæ 17.
 Orbital setulæ not descending below bases of antennæ 21.

17. Hind tibia with some outstanding setulæ basad of the antero-dorsal bristle in a single series 18.
 Hind tibia without outstanding setulæ basad of the usual antero-dorsal bristle.. 20.
18. Hind tibia with at most two antero-ventral bristles; hind femur with two strong bristles on apical third of antero-ventral surface; hind coxæ each with two fine hairs at apex above; setulæ continued downward on parafacials midway to lower margin; dorsum of thorax with three brownish vittæ **canicularis*, Linné.
- Hind tibia with three or four antero-ventral bristles; hind femur with four or five strong bristles on apical half of antero-ventral surface; hind coxæ each with one fine hair at apex above; setulæ not carried so far downward on parafacials; dorsum with four indistinct dark vittæ .. 19.
19. Orbits and dorsum of thorax densely grey-pruinose; mid-femur with an outstanding bristle at base below..... **scalaris*, Fabricius.
- Orbits and dorsum of thorax sparsely grey-pruinose; mid-femur with a short fine hair at base below..... **incisurata*, Zetterstedt.
20. Ocellar triangle short, not extending to middle of frons; parafacials of moderate width; postero-ventral surface of fore femur with a series of strong bristles.... †*glaucescens*, Zetterstedt.
- Ocellar triangle long and slender, extending well beyond middle of frons; parafacials linear, almost obliterated below; postero-ventral surface of fore femur with a series of short hairs and one strong preapical bristle..... [*femorialis*, Stein.
maculata, Stein,
pusio, Wiedemann, *trispithiophora*, Malloch.
21. Palpi dilated, spoon-shaped 22.
- Palpi normal, but little dilated apically .. 22.
22. Hind tibia with three or four antero-ventral bristles; fore tibiae broadly yellowish at bases **manicata*, Meigen.
- Hind tibia with one antero-ventral bristle. 23.
23. Scutellum bare except for the four strong marginal bristles; each orbit with five bristles, the fine setulæ almost entirely absent; last section of fourth wing-vein less than twice as long as preceding *latifrons*, Malloch.
- Scutellum and frontal orbits both with numerous setulose hairs in addition to the strong bristles 21.
24. Hind tibia with two moderately long antero-dorsal bristles; frontal orbits slightly shining, densely grey-pruinose. sp. n.?
- Hind tibia with one antero-dorsal bristle .. 25.
25. Frontal orbits not highly polished, with evenly distributed grey pruinoscence on their entire surface 26.

- Frontal orbits very highly polished, without distinct pruinescence except anteriorly, or with very faint pruinescence on posterior portions 28.
26. Interfrontalia with dense white pruinescence when seen from in front; acrostichals in three series anteriorly **area*, Meigen.
Interfrontalia not as conspicuously pruinulent as the orbits; acrostichals in two series 27.
27. Each orbit at least as wide as interfrontalia at its narrowest part; lower calyptra smaller than the upper **postica*, Stein.
Each orbit narrower than interfrontalia at its narrowest part; lower calyptra larger than the upper sp. ?
28. Parafacials at base of antennæ almost linear; frontal orbits absolutely devoid of pruinescence above anterior extremity *immaculata*, Malloch.
Parafacials at base of antennæ nearly as wide as third antennal segment; frontal orbits with discernible pruinescence on entire surface, most dense anteriorly **serena*, Fallén.

Fannia benjamini, Malloch.

Stein has placed this species as a synonym of *flavipalpis*, Stein, described from South America. A careful comparison of specimens of *benjamini* from the western United States with his description of *flavipalpis* shows that they are either entirely distinct or that Stein had a peculiar faculty of omitting the salient features of a species in describing it, which last assumption is not borne out from an examination of his work in general.

Subfamily *CÆNOSIINÆ*.

Genus *ATHERIGONA*, Rondani.

I have accepted tentatively for this genus the subfamily relegation of authors, but consider it entirely probable that it may have to be removed to some other subfamily, probably Phaoniinæ or even Muscinæ. The matter will be dealt with when I complete my revision of the genus.

Atherigona brunneoapicata, sp. n.

Male.—Head (including antennæ and palpi) black, orbits, occiput (except in middle), face, and cheeks yellowish-grey pruinulent; arista brown, face testaceous below; entire interfrontalia fuscous. Thorax densely yellowish-grey pruinulent, with three narrow brown dorsal vittæ. Abdomen

yellowish basally, becoming darker apically, with grey pruinescence, and paired brown spots on tergites, the spots on first visible tergite pale and diffused, those on second large and subquadrate, those on next two tergites much smaller and round, second and third tergites with an additional central elongated dark mark. Legs tawny yellow, fore femora and tibiae (except their bases), and all tarsi fuscous, hind tibia browned apically. Wings hyaline, with a narrow dark brown border from in front of apex of second vein to apex of fourth. Calyptreæ and halteres whitish.

Fore femur without a dorsal concavity, but with a series of quite dense and moderately long black hairs on postero-dorsal surface, which are mostly curled slightly and extending from near base to near apex; about three straight bristles on posterior side near apex, and one or two preapical postero-ventral bristles; tarsi and other legs normal. Abdomen short and stout, tergites 2 and 3, and especially the latter, produced downward, meeting on middle of venter and entirely enclosing the sternites; abdomen in other respects similar to that of *excisa*, Thomson. Inner cross-vein at middle of discal cell; outer cross-vein straight; first posterior cell slightly narrowed at apex.

Length 4 mm.

Type, Sungai Taban, Pahang, F.M.S., at light, 1. xii. 1921 (*H. M. Pendlebury*).

This species belongs to the same group as *excisa*, Thomson, despite the absence of a dorsal concavity on the fore femur, the genitalia presenting similar external characters. The peculiar hairing of the fore femur, the narrow dark brown margin of the wing, and the lack of a chitinated prominence of the tergite in front of the base of hypopygium distinguish the species from any of its allies known to me.

With the male there are two females, one of which may belong to this species, but there is so much difference between the sexes of the species of this genus that I am deferring the description of this sex.

The specimen was sent to me for identification along with many more by the collector, who instructed me to deposit the types of any new species in the British Museum.

Subfamily *Musornæ*.

Orthellia scatophaga, sp. n.

Male.—Head black, cheeks with a violet-blue tinge. Thorax without dorsal pruinescence, metallic blue, dorsum of a violet or purplish colour. Abdomen with the basal three

tergites metallic violet or purplish, the fourth blue-green. Legs black, femora largely metallic blue. Wings clear, fuscous in basal cells, veins black. Calyptreæ fuscous, with the hind margin of the lower one narrowly and the connecting angles both white. Halteres fuscous.

Eyes almost bare, facets on upper half much larger than those on lower half; narrowest part of frons not as wide as third antennal segment, orbits with short fine hairs on their entire length; parafacials narrow above, sides of face widened below, the vibrissæ separated by about twice as great a distance from eye as from each other; vibrissal angle not much produced; facial ridges haired to above middle. Thorax smooth, with two pairs of presutural and two or three pairs of prescutellar dorso-centrals, all short; prescutellar acrostichals present; posterior intra-alar distinct. Abdomen smooth, without strong bristles. Mid-tibia without an antero-dorsal bristle, with about four posterior bristles; hind femur with some antero-ventral bristles on apical half and two or three on basal half of postero-ventral surface; hind tibia with about two short bristles on each of the following surfaces—antero-ventral, antero-dorsal, and postero-dorsal. A fine hair at base of first vein behind; bend of fourth vein angular.

Female.—Differs from the male in having the frons about one-third of the head-width, each orbit wider than interfrontalia, especially in front, the upper half of each orbit violet-blue, the anterior half and parafacials silvery white, upper half of orbits with fine black hairs. The most striking distinction between the sexes lies in the colour of the calyptreæ, those of the female being entirely white, with the upper except the connecting portion translucent.

Length 6-7 mm.

Type, male, allotype, and a male and female paratype, reared from cow-dung, Prospect, C.P., South Africa, iii. 1924 (Ac. E. L. 233).

This species in the female sex will run down to *lutifrons*, Malloch, in my recently published key to the species of the genus (Part XI.). That species differs in having the upper part of orbits less glossy, with faint pruinescence, and greenish, not sharply differentiated from the lower half; the interfrontalia wider than either orbit; mid-femur with a quite prominent bristle terminating the anterior series of bristles near middle of femur, which bristle is not evident in *scatophaga*, and a series of bristles on antero-ventral surface which are quite short but stout, instead of one or two short

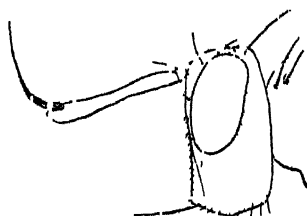
fine bristles as in the new species. The colour of the type-specimen of *latifrons* is uniformly blue-green, but in this genus colour does not signify much as a rule.

The puparia mounted with three of the type-series of *scutophaga* show the posterior spiracular discs contiguous, with a distinct button and serpentine slits.

Family Tachinidæ.

Genus ORECTOCERINA, nov.

Generic Characters.—Head from the side about twice as high as long, appearing compressed from in front (see text-fig.); face foveate below bases of antennæ, viewed from in front at least twice as wide as widest part of eye; antennæ porrect (as in figure); proboscis short. Postscutellum well



Head of female of *Orectocerina atratula* from the side, much enlarged.

developed; prosternum bare; dorsal armature of thorax well developed; scutellum with a pair of discal and eight marginal bristles. Abdomen broadly ovate, with marginal bristles on third and fourth visible tergites. First posterior cell of wing open, ending in tip of wing, fourth vein with a rounded bend, third with a few setulæ at base; first vein bare; inner cross-vein about one-third from apex of discal cell. Hind tarsus without basal ventral bristle.

(Genotype, the following species.)

Orectocerina atratula, sp. n.

Female.—Black, shining. Face slightly, occiput rather densely whitish pruinose; second antennal segment and base of third brownish yellow; palpi not distinguishable in type because of retraction of proboscis. Thorax greyish pruinose, the dorsal vittæ not readily distinguishable

because of the presence of a dark dot at base of each hair and bristle. Abdomen dotted like mesonotum. Legs black. Wings clear. Calyptreæ white. Halteres yellow.

Head about as wide as thorax, the latter with 2+3 pairs of dorso-central bristles and distinct acrostichals which become weak in front of suture; both pairs of intra-alars and the prealar bristle present. Basal abdominal sternite hairy. Fore tibia with a series of seven or eight antero-dorsal, four postero-dorsal, and two longer posterior bristles; fore tarsi rather thick basally; mid-tibia with one ventral, one antero-dorsal, about four postero-dorsal, and two posterior bristles; hind femur with about three preapical antero-ventral and the same number of postero-ventral bristles; hind tibia with four or five postero-dorsal and antero-dorsal and about three antero-ventral bristles.

Length 5 mm.

Type, Gunong Tahan, Padang, F.M.S., 5550 feet, 16. xii. 1922 (*H. M. Pendlebury*).

This genus runs down to *Admontia* in Williston's 'Manual of North American Diptera,' but the very strikingly elongated antennæ, with its almost apical arista, distinguishes it from that or any other genus known to me.

The type-specimen will be deposited in the British Museum through the generosity of the collector.

LV.—On some new Species of Red Spider.

By STANLEY HIRST.

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[Plates XVI. & XVII.]

RAOIELLA, gen. nov.

Allied to *Tenuipalpus*, Donn. Chelicera long and fine, being styliform. Palp very small, consisting only of two short segments. Legs short, especially the posterior ones; both claws well developed. Penis a very long and fine style without terminal barbs. Hairs on dorsum much longer than in *Tenuipalpus*.

Raoiella indica, sp. n.

♂. A pair of eyes is present on each side of the body anteriorly; anterior eye well rounded, the posterior one more

irregular in shape, being slightly the larger. A little behind the third pair of hairs on the dorsum there is a distinct transverse line, forming the boundary between cephalothorax and abdomen, but this line is most distinct in the middle. A little distance behind there is another shorter and weaker transverse line. *Breathing apparatus* very complicated, the part of it which is visible on the dorsum consists of numerous parallel tubes placed close together to form an elaborate collar or organ-shaped structure. *Penis* very long and exceedingly fine; posteriorly there is a little caudal structure having lateral cones, each bearing a hair and a longer central projection which seems to serve as the guard for the penis. *Hairs* on dorsum fairly stiff, curved, rather slender, and distinctly but not strongly plumose, the tips being enlarged. These hairs are thirty in number, six being placed on the cephalothoracic part, two pairs being situated in front of the eyes and one pair behind them. First two rows of abdominal hairs six in number and arranged transversely, the outermost pair being unusually long. Lateral hairs usually considerably longer than the inner ones, some of the median hairs on the abdominal part of the body being much shorter than the other hairs. *Chelicera* in the form of a long and very fine style. *Palp* very short, apparently consisting of two segments—a very short proximal one bearing a hair and a more elongated distal segment bearing two fine hairs and a slender terminal finger. Claws of *legs* both well developed; besides the eight usual rather long tenent hairs, there are numerous shorter tenent hairs borne on a median bar-like process situated between the real claws. Tarsus of first leg with four slender sensory setae or hairs which are stiff, slender, and rod-like; one on the dorsal surface is much longer than the others. There are also fine feathered hairs on the legs, some being fairly long.

♀. Body shaped very like that of *Tetranychus*. Hairs on dorsum very like those present in the male sex, the tips of the hairs of the last pair wider and more flattened than the others. Tarsus of palp and also the claws of the legs very similar in structure in both sexes.

- *Measurements*.—♂. Length (including palpi) .21 mm.

♀. Length (including palpi) .29-.30 mm.

- *Locality and Host-plant*.—Coimbatore, South India. From coconut leaves, 4. ix. 1923 (A. G. Ramaswamiiah).

Tetranychus fijiensis, sp. n.

♂. *Penis* long, slender, tapering but curved, being without

any enlarged tip or barbs. Terminal finger of tarsus of *palp* slender and fairly long; dorsal finger of same of moderate length, slender and slightly club-shaped. Claws of all the *legs* shaped as in the female, being very like those of *T. telarius*; there is a slender, curved, dorsal, claw-like portion and a ventral part split into hair-like processes, which are fewer, however, than in *T. telarius*: these hair-like processes are from three to four in number?, the ventral ones being much longer than the others.

♀. End of *collar trachea* shaped very like that of *T. telarius*, but the three terminal cells rather more irregular. Terminal finger of tarsus of *palp* much stouter than in the male; dorsal finger club-shaped, being rather slender and not very long. Claw of *palp* blunt, the tip being almost truncated and sometimes slightly indented. Claws very like those of the male; tenent hairs four in number.

Measurements.—♂. Length (including mandibular plate) .35 mm. ♀. Length (including palpi) .52 mm.; length of terminal finger of *palp* in female 6–7 μ , its height 4 μ .

Hab. On coconut, Ovalau, Fiji, 30. v. 24 (H. W. Simmonds Coll.). Specimens received from the Imperial Bureau of Entomology.

Paratetranychus isilemæ, sp. n.

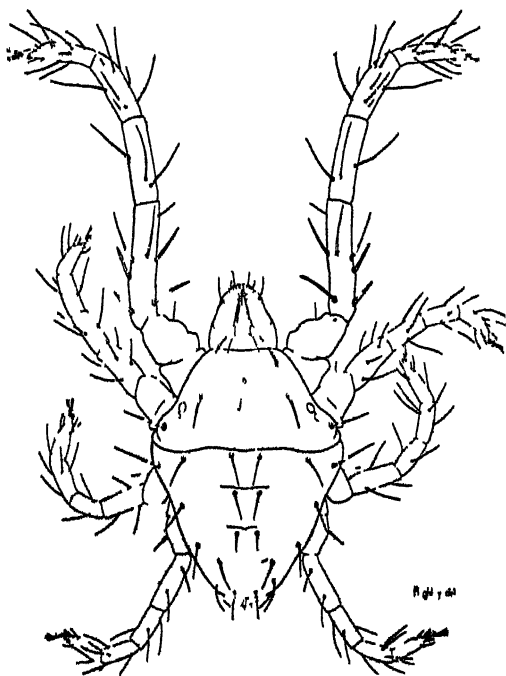
♂. *Penis* shaped as figured, being strongly curved so as to form a slender hook without barbs. Terminal finger of *palp* (A in figure) moderately long, being shorter than the longer of the two stiff rod-like setæ placed close to it. Dorsal finger (B in figure) slender, cylindrical, and shorter than the terminal finger. First *leg* with the usual upper claw-like portion, but also with a strong curved ventral process divided into teeth distally; the usual cluster of hairs is apparently replaced by this toothed ventral part, which resembles somewhat the similarly placed structure present in the male of *Tetranychus lintearius* etc. Posterior legs normal for the genus, consisting of a long, slender, curved claw and the usual projection, splitting distally to form a cluster of rather long fine hairs.

♀. Anterior *eye* distinct, being provided with a convex lens; the posterior eye is weak, but still visible. Hairs on dorsum long and fine, the secondary hairlets on them are very fine and inconspicuous, only being visible when considerably magnified. *Collar trachea* of a very simple type, being very like that of *Tetranychus telarius* (text-fig.). Processes at end of *palp* very similar to those of the male,

except that the terminal finger is slightly shorter. Claws of all the legs normal for the genus.

Measurements.—Length of male (including capitulum with palps) $245\ \mu$; of female $345\ \mu$.

Locality and Host-plant.—Coimbatore, South India. Specimens collected by A. G. Ramaswamiah on leaves of *Isilema laxum*, and forwarded to me for identification by Dr. Ramachandra Rao of the Coimbatore Entomological Station.



Tetranychus (Schizotetranychus) hindustanicus, sp. n.
Dorsal view of male.

Tetranychus (Schizotetranychus) hindustanicus, sp. n.

♂. Dorsal hairs fine, not very long, and almost plain, the feathering being very slight and inconspicuous; these hairs do not arise from tubercles, as is the case in *Paratetranychus*, but from triangular (almost heart-shaped) sockets. A single eye distinct and rounded in outline, the posterior obsolete, being difficult to distinguish. *Penis*

shaped very like that of *T. schizopus*, Zacher, but the tip not so slender as in that species. Terminal finger of *palp* absent, its place being taken by a rather long, cylindrical, rod-like seta, which is straight and pointed distally. Dorsal finger of tarsus of *palp* short, rather slender, and club-shaped; close beside it there is a short, pointed, rod-like seta of about the same length. First *leg* the longest, but its tarsus is short. Claw of first *leg* short, stout, and divided into two forks or branches, the tips being slightly split or indented. Claws of legs 2-4 also apparently forked, but the two branches are difficult to see, for they lie close together; there is also a slender, curved, claw-like structure placed above these two slender branches. Seven tenent hairs seem to be present near the claws of the first *leg* (possibly the eighth has been broken off accidentally?); apparently only four tenent hairs occur on the posterior legs, but probably some have been broken off.

Measurements.—♂. Length (including palpi) .35 mm.; total length of penis about 39 μ , but the external part only 15 μ . Rod-like seta at end of tarsus of *palp* 6 μ ; dorsal finger of same 4 μ ; the short rod-like seta 4 μ .

Locality and Host-plant.—Coimbatore, South India, 13. iii. 1924. Specimens from *Citrus*, sent by Dr. Y. R. Rao.

Note.—This species is very closely allied to the European species *Tetranychus* (*Schizotetranychus*) *schizopus* which occurs on willows, the structure of the claw of the first *leg* being exactly the same in both species, but the two forks or branches of the posterior legs are much more slender in the new Indian species.

Paratetranychus pini, nom. nov.

The species occurring on *Pinus sylvestris*, described under the name *P. ununguis* in my paper on the English species of red spider, is not the same as that described by Trägårdh (Stockholm Medd. Centralanst. Försöksv. Jordbruksomr. 1915, no. 109, pp. 29-32, text-figs.), and I propose the name *pini* for my species. Mr. G. B. Kyle has procured me number of specimens of a species of *Paratetranychus* from spruce which seem to me to be the real *P. ununguis*, the shape of the penis being as figured by Trägårdh.

Paratetranychus ununguis, Jac.

♂. Size larger than *P. pini*. Penis different in shape, the end being more slender and drawn out. Terminal finger

of *palp* much stouter than in *P. pini*; the dorsal finger also much stouter. One of the stiff, terminal, rod-like setæ of the tarsus of the palp is very slightly conical.

Length (including palpi) about 45–50 mm.; length of terminal finger of palp nearly 4 μ , its width 3 μ ; length of dorsal finger 4 μ , of stiff rod-like terminal setæ 4 μ .

Locality and Host-plant.—Pangbourne, Berks; a number of specimens from spruce, August 1924 (*G. B. Ryle*).

EXPLANATION OF THE PLATES.

PLATE XVI.

Raoiella indica, gen. et sp. n.

- Fig.* 1. Dorsal view of male.
- Fig.* 2. Penis.
- Fig.* 3. Breathing apparatus.
- Fig.* 4. Palp of male.
- Fig.* 5. Claws of a posterior leg.
- Fig.* 6. Claws of first leg.

PLATE XVII.

Tetranychus fijiensis, sp. n.

- Fig.* 1. Tarsus of palp of female.
- Fig.* 2. Tarsus of palp of male.
- Fig.* 3. Distal end of leg.
- Fig.* 4. Penis.

Paratetranychus isilemæ, sp. n.

- Fig.* 5. Palp of male.
- Fig.* 6. Penis.
- Fig.* 7. Palp of female.
- Fig.* 8. Claw of first leg of female.
- Fig.* 9. Collar trachea.
- Fig.* 10. First leg of male.

Paratetranychus unguis, Jac.

- Fig.* 11. Palp of male.
- Fig.* 12. Penis.

Tetranychus (Schizotetranychus) hindustanicus, sp. n.

- Fig.* 13. Tarsus of palp of male.
- Fig.* 14. Claws of posterior leg of male.
- Fig.* 15. Claws of first leg of male.
- Fig.* 16. Another view of claws of posterior leg.
- Figs.* 17 & 18. Two views of the penis.

LVI.—*A new Pouched Mouse* (Phascogale) *from Northern New South Wales.* By OLDFIELD THOMAS.

THE British Museum has received from Capt. Wilkins a series of pouched mice of the genus *Phascogale* collected in the Guy Fawkes district of New South Wales. Of these the majority represent the *flavipes* group, but one, superficially very like the rest, proves to be related to the southern *Ph. swainsoni*, of which it appears to form a distinct subspecies.

Phascogale swainsoni *mimetes*, subsp. n.

A New South Wales representative of the Tasmanian and Gippsland *Ph. swainsoni*.

Essential characters, including the elongate fore claws and peculiar skull and tooth characteristics, as in true *swainsoni*. Fur, however, not so thick and woolly; hairs of back about 9 mm. in length. General colour, instead of being uniform coppery or umber brown, dark grey, lighter on the fore back, darker and more brownish on the rump—in fact, very similar to that of the local ally of *Ph. flavipes*, although slightly darker on the rump. Under surface dark grey-brown, the bases of the hairs deep slaty, their tips paler and with a slight cinnamonaceous tinge posteriorly. Hands and feet dark brown. Tail short-haired throughout, blackish above, slightly paler on sides and below.

Skull quite as in *swainsoni*, with the same narrow elongate muzzle and long palatal foramina, extending in the type to the level of the back of p^1 . Bullæ perhaps a little more salient.

Teeth as in *swainsoni*.

Dimensions of the type:—

Head and body 125 mm.; tail 92; hind foot 22; ear 18.

Skull, condylo-basal length 30.5; zygomatic breadth 15; nasals 12×4 ; intertemporal breadth 7.8; dental length 16.7; molars¹⁻³ 6.2.

Hab. Northern New South Wales. Type from the Guy Fawkes district, lat. $30^{\circ} 30'$ S., long. $152^{\circ} 30'$ E. Altitude 5000'.

Type. Adult female. B.M. No. 24.10.1.1. Original number 430. Collected by Capt. G. H. Wilkins. One specimen.

Just as in the north of Queensland we have a larger and smaller species of *Phascogale* occurring together—*Ph. godmani* and *unicolor adusta*—and very similar to each other,

so here this animal occurs with another local race of the *flavipes* group, and is indeed so like it as to have suggested the name now given to the subspecies. But in the present case there is no near relationship between the two, the new form being in all essential respects a representative of *swainsoni*, of which, in spite of its great geographical separation, it should apparently be considered a subspecies.

The companion pouched mouse, of which Capt. Wilkins got a good series, is the form to which Gould gave the name of *unicolor*, and, with the nearly allied northern subspecies *adusta*, is so different externally from the typical grizzled grey and yellowish *flavipes* that the two, in spite of the absence of cranial distinctions, should probably be considered as specifically distinct. Besides the difference in colour *flavipes* has a more heavily haired tail, with a greater tendency to penicillation. The northern form, which I should therefore now call *Ph. unicolor adusta*, proves to be more nearly allied to true *unicolor* than I had previously supposed, but may be distinguished by having the under surface always strongly cinnamon, while it is only in extreme old age, as illustrated by the type, that this colour appears in *unicolor*.

Capt. Wilkins also obtained an example of the tiny *Ph. minutissima*, Gould, at Westwood, near Rockhampton.

LVII.—A new Genus of Bythoscopinæ (Jassidæ, Homoptera)
from West Australia. By W. E. CHINA.

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POGONOSCOPUS, gen. nov.

Crown with the eyes distinctly narrower than the pronotum at the base, twice as long at the eyes as in the middle; face long, nearly one-fifth longer than the width between the anterior margins of the eyes, moderately convex, with a slight depression around and below each ocellus; ocelli placed in a line with the middle of the eyes as seen from below, and slightly nearer to each other than to the eyes; antennal scrobes shallow, antennal bristles short; clypeus moderately broad, lateral margins of genæ very feebly sinuate, almost straight; rostrum extending to the third apparent abdominal ventrite. Pronotum rather more than twice as wide at the base as long in the middle, its lateral margins not carinate

and converging anteriorly so that they form almost a continuous curve with the rounded anterior margin; posterior margin rather broadly emarginate above the scutellum, disc broadly convex, very faintly transversely rugose but not striate, with two transverse smooth areas below the eyes.

Scutellum slightly wider at the base than along the lateral margin. Tegmina moderately coriaceous, venation somewhat variable towards the apex, similar to that in *Bythoscopus* (type, *lanio*, F.), but with only two anteapical cells and the costal area consequently very wide towards the apex of the tegmen; appendix present. Tibiæ much less distinctly triangular than is usual in the Jassidæ, the angles more or less rounded. Tibial spines very feebly developed.

Genotype: *Pogonoscopus myrmex*, sp. n.

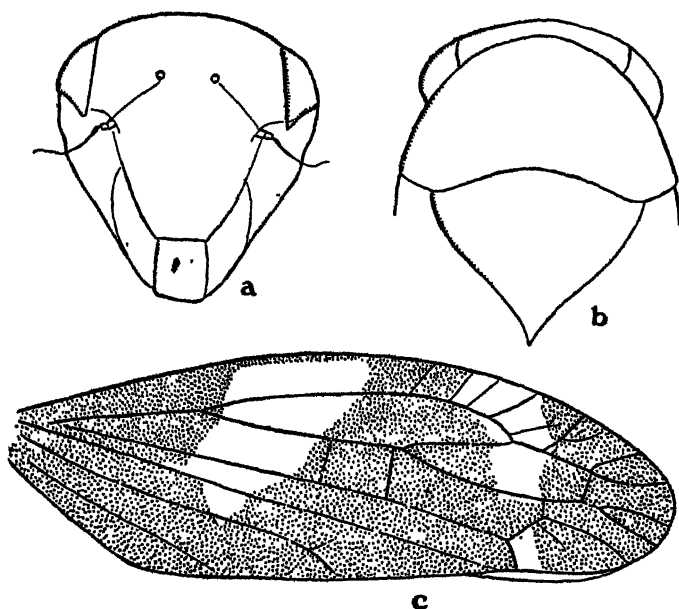
Although resembling some of the Eurymelinae in general appearance and type of colouring, this genus lacks the Cercopid-like tibial spurs and broad head of that group. It is, however, related to *Bythoscopus* (type, *lanio*, F.), from which it differs by the somewhat narrower crown, the longer face, the shallower antennal scrobes, the closeness of the ocelli, the longer and non-carinate lateral margins of the pronotum, the absence of transverse pronotal striations, the absence of a third anteapical cell, the more or less rounded tibiæ, and the very feeble tibial armature. It is probable that *Eurymeloides acmæops*, Jacobi*, and *E. lenis*, Jacobi, both described from West Australia, belong to this genus.

Pogonoscopus myrmex, sp. n.

♀. Crown dark brown, paler along the basal margin; upper part of face between the eyes brownish black, covered with very short pale hairs, lower part below the antennæ and ocelli ochraceous, the frons, clypeus, and loræ covered with long and shaggy pale hairs. Pronotum brownish black, with a median longitudinal line on the basal two-thirds and the basal margin rather widely yellowish brown, covered with a very fine pale pubescence. Scutellum brownish black, paler towards the apex. Tegmina dark brown, with two white fasciæ—one large commencing in the middle of the clavus and widening towards the costal margin, another smaller extending across the outer anteapical cell to the costal margin on a level with the apex of the clavus—and a white spot at the base of the inner apical cell, the lower margin of the

* "Die Fauna Südwest-Australiens," *Ergeb. d. Hamburg. S. Austral. Forschungs.* 1905, Michaelsen u. Hartmeyer, Band ii. Lief. 20, p. 340, fig. 5 (1909).

discal fascia and the upper margin of the apical fascia converging towards the costal border; appendix whitish hyaline. Wings hyaline, with veins brown. Legs and abdomen below pale ochraceous, with the pygofer and ovipositor brownish; posterior margin of last ventrite with a rather



Pogonoscopus myrmex, sp. n.

a, face; b, crown and pronotum; c, tegmen.

broad semicircular median incision, the remainder convexly sinuate on each side.

Total length 9 mm; width across base of pronotum 3 mm.

Described from material preserved in spirit.

3 ♀♀, West Australia, Perth (*J. Clark*); November 1920. Attended by ants, *Camponotus* (*Myrmophyma*) *testaceipes*, Smith.

LVIII.—*Un Scymnus (Pullus) nouveau de Mexique* (Col., Coccinellidæ). Par Dr. A. SICARD.

Parmi quelques Coccinellids communiqués par M. Guy A. K. Marshall se trouvaient deux espèces de *Scymnus* de Mexique.

Une de ces espèces ne me paraît se distinguer du *Sc.* (*Dionysus*) *margipallens*, Muls., du Brésil, que par la bordure

apicale claire des elytres un peu plus nettement marquée que dans l'exemplaire typique de la collection Mniszech actuellement en ma possession. Ce caractère ne me paraît pas suffisant pour le différencier de cette espèce, d'autant plus que les exemplaires communiqués sont plus frais que celui que je possédais déjà.

La deuxième espèce me paraît nouvelle, et j'en donne ci-dessous la description.

Scymnus (Pullus) *uncinatus*, sp. n.

Late ovatus, parum convexus, brunneus. Prothorace rufo, medio infuscato (♂), nigro lateribus rufis (♀). Elytris nigris, apice tenue testaceis, macula elongata obliqua, in medio stricta, ad apicem dilatata, externe producta; subtus brunneus, abdomino rufo medio leviter infuscato. Laminis abdominalibus integris; prosterno carinulato; pedibus testaceis.

Long. 1.5-1.8 mm.

En ovale large, peu convexe, luisant, couvert d'une pubescence grise courte et peu dense. Tête roussâtre dans les deux sexes. Corselet roux, marqué d'une tache noire à la base (♂), ou noir avec les côtés étroitement roussâtres. Elytres largement arrondis à l'extrémité, droits sur les deux tiers des côtés, à calus huméral très peu saillant, noirs avec l'apex étroitement testacé et marginé en outre d'une tache allongée, légèrement oblique en arrière et en dedans, étendue du quart aux cinq sixièmes de la longueur environ et paraissant formée de deux taches réunies par une partie étranglée plus sombre, la tache antérieure rougeâtre, la postérieure testacée, cette dernière plus grosse, un peu transversale et recourbée en dehors et en avant, l'ensemble formant ainsi un crochet ou un point d'interrogation renversé. Dessous brun sur la poitrine et le milieu du ventre avec le reste de l'abdomen plus clair. Pieds entièrement testacés. Plaques abdominales entières; prosternum finement carinulé.

Cette espèce est originaire du Mexique et a été acclimatée à Honolulu, d'où viennent les exemplaires qui m'ont été communiqués, envoyés par M. Pullaway.

Son dessin l'éloigne de toutes les espèces décrites jusqu'ici. Le *Sc. bisbinotatus*, Gorb., en est bien distinct par son corselet noir, ses elytres à apex concolore, la forme et la direction de ses taches. Des exemplaires chez lesquels la tache antérieure serait absente ressembleraient assez comme dessin au *Sc. pictus*, Gorb., mais ce dernier est plus convexe, plus acuminé en arrière, ses elytres n'ont pas de bordure apicale, son corselet est entièrement rouge et sa taille plus petite.

LIX.—*The Phylogeny of the Cirripedia.*

By RUDOLF RUEDEMANN.

MR. THOMAS H. WITHERS has been so friendly and considerate as to send me the manuscript of his paper* on the phylogeny of the Cirripedia. In this the views expressed by Dr. John M. Clarke (1916) on the phylogeny of the Lepadidæ and by the present writer (1916, 1924) on the phylogeny of the Balanidæ are subjected to severe criticism.

While we are fully aware that Mr. Withers has behind him as support his wide experience and thorough knowledge, shown in so many excellent publications, of the Mesozoic and later Cirripedia of many parts of the world; we also know that there are two sides to every question, and we therefore venture to set forth our views in this place in the hope that, even if not accepted by the students of Mesozoic and recent barnacles, they may help to animate discussion and bring out new facts.

It is obvious that Mr. Withers and the writer have approached the problem of the phylogeny of the barnacles from opposite ends, so to speak, and are arriving at divergent views. Mr. Withers has chosen the safe and cautious way of tracing the phylogeny of the barnacles from the recent forms carefully backward to the early Mesozoic forms, where the direct record ends. Far back of these latter there appear in the Palæozoic formations—the Ordovician, Silurian, and Devonian—various fossils which have been referred to the cirripedes. The writer has in the papers under criticism attempted to project the phylogeny from one of these, *Eobalanus*, through the Devonian *Protobalanus* to the recent acorn-barnacles, and is thereby brought into conflict with the view held by Withers and students of the Mesozoic and later barnacles in general that the suborder Balanomorpha is derived from the Lepadomorpha and is of more recent origin than the latter.

The result of Mr. Withers's method of retracing the phylogeny has been that, in view of the great time-interval between the earliest-known Mesozoic and the last-known Palæozoic cirripedes and of the wide differences in structure between the two groups, he has arrived at the conclusion that the Palæozoic "Cirripedia" are not to be considered

* Ann. & Mag. Nat. Hist. ser. 9, vol. xiv. pp. 318-324 (1924).

as belonging to that class at all. In his paper on "Some Palaeozoic Fossils referred to the Cirripedia" (1915) it was already stated that *Turrilepas*, *Plumulites*, and *Lepidocolenus* were extremely doubtful cirripedes, and *Hercolepas*, *Protobalanus*, and *Palaeocreusia* were considered as "the only Palaeozoic forms that can be referred with any justification to the Cirripedia." It was said that "*Hercolepas* is an undoubted Cirripede, and, while there is very little doubt with regard to *Protobalanus*, there is more doubt in the case of *Palaeocreusia*." Now Mr. Withers rejects even *Protobalanus* and his own genus *Hercolepas* as possible cirripedes, as well as the *Eobalanus* of Ruedemann.

We consider the sweeping rejection of all Palaeozoic cirripedes, while perhaps the logical result of the method of tracing the cirripedes backward in time and of the intensive study of the more recent forms, as not taking into consideration certain facts which we wish to emphasize in this place.

The Cirripedia which appear at the end of the Triassic and in Jurassic time are already, as in *Archaeolepas*, close in structure, with their fully developed capitulum, to the recent barnacles. Highly-specialized forms as they are, they must have had a very long phylogenetic history behind them. This history must lead back to the Phyllopoda, as both the ontogeny and morphology of the cirripedes show; and the earlier ancestors of the cirripedes must have been widely different from the fossils we meet first in the Mesozoic rocks—in fact, so widely different that we could hardly expect to recognize them readily as cirripedes without knowing the intervening stages. To stop, therefore, where this record ends in the late Triassic means to leave the problem of the phylogeny of the cirripedes unsolved, until older and more closely related material is found. If this method is the only one that is satisfactory to the students of recent and Mesozoic barnacles, well and good; but the students of Palaeozoic fossils who continuously meet these strange and problematic forms, that concededly can not be placed anywhere else and that yet look so strangely suggestive of very primitive cirripedes, must be also permitted to speculate on the possible relationship of these fossils with the barnacles and to attempt to project forward from them to their possible descendants. If any of these Palaeozoic "cirripedes" are proven to belong to other groups, as, e. g., were the species of *Scalpellum* described by Aurivillius from Gotland and later through lucky finds placed definitely

with the cystids by Bather (1915)*, so much the better for science; but the fact remains that the other Palæozoic cirripedes have not yet been placed anywhere else. Moreover, on the basis of their structure, it is wholly within the range of possibility that they—at least *Turrilepas*, *Plumulites*, and *Eopollicipes* (see *postea*)—could have led to the later barnacles. The latter have indeed been connected with the Palæozoic forms, even after the appearance of Withers's critical paper of 1915, by such a serious student of the cirripedes as Joleaud (1916) in France, who even created a separate suborder, the Protocirripedia†, for these Palæozoic forms. Joleaud's conclusion that the development of the later forms from the Protocirripedes took place by a "displacement" of the body of the animal in antero-posterior direction and a division of the tubular plate-covering of the animals into two zones, one with smaller plates (the later peduncle) and one with larger plates (the later capitulum), is a logical inference from a comparison of the structure of the shell of the supposed Palæozoic cirripedes and that of the earlier Mesozoic forms. Withers (1920, p. 81) has done so himself, when he says: "While it is difficult to see how *Turrilepas* could give rise to a form like *Loricula*, there is little doubt that certain of the stalked cirripedes were evolved from other cirripedes in which the *capitulum* and *peduncle* were not well defined. This is borne out not only by the post-larval development of recent pedunculata cirripedes, but by the forms of *Archæolepas*." (Italics ours.)

It is the same idea, expressed in other words, as Doctor Clarke's, when he (1918, p. 385) would consider the scaly stalk of the Palæozoic cirripedes as representing rather the capitulum, since the structure is terminated only by a single plate. Also Grunel and Pompeckj (1912) consider the lack of distinction of peduncle and capitulum an early and primitive character of the Pedunculata or Lepadomorpha.

In comparing the Mesozoic Lepadomorpha with the recent ones on the one hand and the supposed Palæozoic ancestors

* The smooth plates of the peduncles of the species of *Dyrgocystis*, which were taken for species of *Scalpellum* by Aurivillius, differ from those of *Turrilepas* and *Plumulites* by the absence of the characteristic sculpture and their greater thickness. The writer has before him a new peduncle of this kind from the Bertie water lime at Buffalo.

† As did also v. Reichenbach (1909), who proposed the term Palæothoracica, and Pilsbry (1916), who united them in the suborder Turrilpadomorpha.

on the other, it is noted that the plated peduncle of the Mesozoic forms is relatively much wider and larger than that of the later forms—*e. g.*, in the Cretaceous *Stramentum* the capitulum is only one-fifth the size of the peduncle. This can only mean that the peduncle then retained a larger part of the body than now, when only the ovary is placed there. Withers (1920, p. 79) says: "The general structure of the shell of that early form of *Archaeolepas* also points to the probability that, as in *Stramentum*, the greater part of the animal's body was lodged in the peduncle." This condition, when developed logically to still more primitive forms, must lead to the condition we find in the Palaeozoic Lepadomorpha, as *Plumulites* and *Turrilepas*, where the "peduncle" is practically the whole fossil. The statement made by several authors, that these earliest lepadids had no capitulum yet, is therefore not so much to be considered as proving that since they had no capitulum they were no cirripedes at all, but rather that the earliest cirripedes had no capitulum yet, because their bodies were all in the "peduncle." This is then an analogous case to that of the original importance, as the receptacle of vital organs, of the stem of the cystids and crinoids and the siphuncle of the cephalopods.

There is other independent evidence for the conclusion that the capitulum, however important now, is only of secondary development. Its different composition in the balanids and lepadids is already suggestive, for while the lepadid capitulum contains the carina, rostrum, scuta, and terga, that of the balanids is composed only of scuta and terga, while the carina and rostrum are parts of the wall or parapet. The capitula of the lepadids and balanids are therefore not homologous in composition. For this reason we agree fully with Pilsbry's conclusion that "the Balanomorpha are not descended from Mesozoic *Scyllalepas*, but rather that both had a common ancestor" (1916, p. 5).

That the capitulum of the Balanidae, composed of scuta and terga only, is of secondary origin is also indicated by the ontogeny. Korschelt and Heider (1899, p. 219) state that the upper part of the mantle which carries the scuta and terga appears like an operculum from an "external secondary mantlefold."

It is in agreement with this view that we consider the absence of a capitulum, and even of "the room for one," as evidence of the primitive structure of *Eobalanus* and *Protobalanus* which had not yet developed a capitulum, instead of

accepting the view of Pilsbry that, because there is no room for a capitulum, these forms (i. e., *Protobalanus*) could not be held to be cirripedes.

While we believe the evidence points to a derivation of the recent Lepadomorpha from Palæozoic forms with a large peduncle, composed of a larger number of series of plates and a more or less undeveloped capitulum, we cannot point to any of the Palæothoracica or Protocirripedes as undoubted ancestors of the Mesozoic Lepadomorpha. Withers (1920, p. 81) has pointed out that *Turrilepas* could not be the ancestor of *Stramentum* (*Loricula*), as was thought by Gruvel, because *Turrilepas* has a triangular transverse section and is composed of four rows of plates

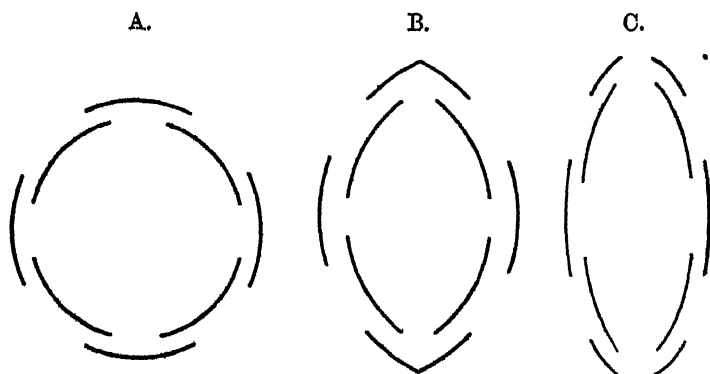


Diagram to show the development of a *Stramentum*-like form from the primitive ancestral lepadid.

A. Ancestral lepadid. B. Transitional stage. C. *Stramentum*.

only. Likewise *Phumulites*, *Lepidocoleus*, and *Strobilepas* are already specialized types that apparently cannot be directly connected with Mesozoic forms. The same is true of *Hercolepas*, although a certain resemblance to the Brachylepadidae is unmistakable, especially in the grooved second ring and the small outer rows of plates.

Considering the striking diversity of plates of the peduncle in the earlier Mesozoic Lepadidae, as exemplified by *Stramentum* (*Loricula*) (see fig.), and the significant fact that the double rows of smaller plates along the sharper edges of the peduncle do not intersect but are in simple contact, we feel quite convinced that these double rows are derived from single rows of a simpler ancestor which had

a peduncle with circular section and eight rows of equal intersecting plates, the development having taken place as indicated in the diagram.

In connection with the lack of evidence in the great gap between the Mesozoic barnacles and their supposed Palæozoic ancestors, two other facts—viz., that of the individual scarcity of the Palæozoic forms and that of their minute size—are of great significance. We have been able to find but three mature specimens of *Eobalanus informans*, in spite of a search of many hundreds of *Ulira* cephalopods in the magnificent Rust collections of the State Museum in Albany and the National Museum in Washington, and but one of the Trenton species as the result of an equally extensive search. Of *Protibalanus*, *Hercolepas*, *Strobilepis*, but a single specimen of each genus is known, in spite of the fact that all three come from horizons teeming with fossils. The separate plates of *Turrilepas* and *Plumulites* are found more frequently, but are never common. This is in striking contrast to the recent barnacles that have taken possession of the intertidal zone of the present coasts and abound in other marine zones. Likewise, the Palæozoic cirripedes are nearly all of very small size, the plates of *Turrilepas* and *Plumulites* being mostly barely visible with the naked eye. The recent barnacles are of much greater size, often of gigantic proportions as compared with the Palæozoic forms.

This is, then, another case illustrating the well-recognized general principle that new classes of animals first appear in small and rare forms, as, *e.g.*, do the star-fishes, cystids, crinoids, brachiopods, and mammals; and that they do not burst out with hordes of individuals and many phyletic lines and attain larger size until they have found the fields to which they are especially adapted, or favourable conditions for their further development have arisen. Wherever these long lines of ancestral barnacles may have subsisted until Mesozoic time, they were neither prominent nor successful until they developed into the highly specialized forms we meet in the Jurassic rocks.

If it is true, as Bather (1914, p. 560) states, that "Up to the present the main reason for referring them (the Palæozoic cirripedes) to the Cirripedia seems to be the difficulty of placing them anywhere else," we would consider this fact that they do not fit into any other class as fair evidence—by exclusion—of their proper reference to the

cirripedes, as long as they present even the remote resemblance they do to the latter in general structure and the shape and sculpture of the plates. However, this resemblance is not remote in all cases. The group of detached plates which the writer (1901, p. 578) described as *Pollicipes siluricus* and compared with the plates of the capitula of *Pollicipes* and *Scalpellum*, while probably not directly referable to either of the two genera as pointed out by Withers, nevertheless approach so closely the shapes of the various plates of a capitulum of the Lepadomorpha, that it appears probable that some of the Paleothoracica had already advanced to the formation of a capitulum*. In *Hercolepas* there has been found even an inner series of five plates in position that appears to represent a fairly advanced capitulum. Comparing this position with that of *Turritepas* and *Strobilepis*, where but one apical plate is observed, it is seen that the Paleothoracica already comprise various stages of advancement of the capitulum and also already fall into widely separated phylogenetic lines.

The problem of the derivation of the Balanomorpha from the Lepadomorpha can not be answered by zoological evidence alone. The latter is currently taken to indicate that the Balanomorpha were derived from the Lepadomorpha by reduction of the peduncle. Darwin and others have suggested the derivation of the *Balanus*-structure from that of the pedunculate genus *Pollicipes* (or *Mitella*). Others have looked to *Brachylepas* as the ancestral form, and *Scillalepas*, especially, has been taken as a probable lepadomorphous ancestor of the Balanomorpha, but Pilsbry (1916, p. 5) states that *Brachylepas*, though superficially like *Catophrugmus* (the primitive recent genus with eight wall-plates), is "evidently not in the line of descent of Balanomorpha." On account of the different system of imbrication of the plates, it does not seem likely to the same author that "*Balanus* descended from Mesozoic *Scyllalepas*, but rather that both had a common ancestor."

* As the generic term *Pollicipes* for our Ordovician species, or group of species, is therefore to be considered as misleading, it will be better to designate this group of plates by a new term, leaving the decision as to their true character to the future discovery of entire specimens. We therefore propose the term *Topollicipes* for these supposed opercular plates. And, as Bather (1901, p. 112) rightly regretted that the author had not designated one of the plates as the holotype of *Pollicipes siluricus*, we designate fig. 17, *op. cit.*, as the holotype.

Accepting *Eobalanus* and *Protobalanus* as proof of the existence of Palæozoic sessile cirripedes or of primitive Balanomorpha, it follows that the latter are not all a late derivation of the Lepadomorpha, but that both appear near the beginning as independent phyla.

It is a corollary of this view that the primitive Lepadomorpha, as represented by *Turpilepas*, *Plumulites*, and *Lepidocoleus* with their long plate-covered peduncles and undeveloped capitula, while the ancestors, or at least forms closely related to the ancestors of the Lepadomorpha, have no such close relation to the Balanomorpha.

The true ancestral form of both lines is given by the "Cypris-stage" of their ontogeny.

We have already emphasized in another paper (1924) the importance of this ontogenetic stage, which has been fully recognized by such authorities as Claus, Balfour, and Korschelt and Heider. In this stage, the larva, both of the Lepadomorpha and the Balanomorpha, is enclosed in a bivalve shell which is directly continuous dorsally. The animal in this stage has nothing in common with the Ostracoda, as the name "Cypris-stage" might suggest (see Korschelt and Heider, p. 214), but a similarly shaped ancestral form is found among the Phyllopoda (*ibid.* p. 209). This bivalve shell of the Cypris-stage is even present when the metamorphosis is much abbreviated, as in *Scalpellum strömii*, where it is developed even in the egg-envelope (see Korschelt and Heider, p. 220).

After the *free-swimming* Cypris-stage follows the *attached* Cypris-stage. We consider it highly important and suggestive for the phylogeny of the barnacles that the attachment takes place in the "Cypris-stage" (see Ruodemann, 1924, p. 98), for it affords the ontogenetic basis for our reconstruction of the development of *Eobalanus* from a phyllopod by fixation.

The fixed Cypris-like larva enters a pupa-stage, during which the larva ceases to feed and loses all power of locomotion, while important external and internal changes are going on in the body beneath the valve, which transformation has been worked out principally by Darwin, Pagenstecher, and Claus. The principal transformations are seen in the change of position of the thorax, which in the earlier stages lay almost parallel to the ventral surface, but later rises into a more perpendicular position with regard to that surface, while the abdomen degenerates almost completely to make room for the greatly enlarged feet and

mouth-parts. Finally, the opercular valves (primary valves of Darwin) appear under the *Cypris*-valves*, the stalk is pushed out from between the anterior portion of the shell-valves of the *Cypris*-stage (arising from that anterior part of the mantle-fold which in the pupa covered the most anterior part of the head), the animal assumes an erect position on its peduncle and the thin outer bivalve shell is pushed off by the plates that form under it.

It is significant that there is always a restricted number of primary valves (five) in the lepadids, even in those which later have a large number of valves.

In the Balanidæ, the metamorphosis in the first stages resembles that of the Lepadidæ, and here also the *Cypris*-pupa gives rise to a young form "attached to a short fleshy stalk" (Korschelt and Heider, p. 219). Only later does the broad base characteristic of the Balanidæ develop and form that external secondary mantle-fold, within which the upper part of the mantle which carries the scuta and terga appears like an operculum.

Combining the facts of the palæontology and morphology of the cirripedes with those of their ontogeny, we can reconstruct the following picture of the early phylogenetic development of the Lepadomorpha and Balanomomorpha. Both divisions arose from a phyllopod ancestor with a bivalve carapace. In the Balanomomorpha the valves of the ancestral phyllopod were split into five plates each, which together with the anterior rostrum (derived from the rostrum of the phyllopod) and the carina (derived from the "dorsal plate" of the phyllopod) made up the twelve compartments of the wall or parapet. This wall originally furnished the entire habitation of the animal. Later, with increasing rigidity of the wall, a set of opercular plates, the scuta and terga, were developed, as we saw above, from a secondary mantle-fold.

* The fact that the "*Cypris*-valve" of the larva is cast off in a moult and the new opercular valves, which according to our view are phylogenetically derived from it, are formed separately under it as new organs, but from the same mantle-fold and at the same place is quite suggestive of the phylogenetic course of events and of the successive replacement of the chitinous and more membranous phyllopod carapace by the more heavily-built calcareous opercular and wall-plates of the barnacle. The carapace itself, in the ontogeny of the barnacle, owing to its solid conchiolinous structure could not be directly split into the wall-plates, as it was in the phylogenetic development, and the process has to be divided into two successive stages, the formation of the exterior chitinous phyllopod carapace as a first stage, and the formation of the calcareous opercular and wall-plates directly under the carapace as a second stage.

While the wall, as in *Eobalanus* and *Protobalanus*, rests directly on a broad base in the mature specimens, it is quite possible that there existed a transitional stage with a short fleshy stalk, such as we find in the "*Cypris*-stage" of *Balanus* for a time, to facilitate sufficient movement for the capture of food until the thoracic limbs are fully developed for that purpose.

In the ancestral *Lepadomorpha* the "peduncle" became early the habitation of the animal, and was therefore provided with a loricate protective structure of plates. The opercular plates, forming the capitulum, consisted originally mainly of the carina, which had the important function of protecting the dorsal side of the animal after the latter had become erect in position. It is important to note that the carina in the larvæ of the lepadids also forms along the dorsal line of the bivalve "*Cypris*-shell," at the same place where the carina of the wall of *Eobalanus* forms from the "dorsal plate" of the ancestral phyllopod. The rostrum forms in the larvæ of both the balanids and lepadids opposite the carina, or along the ventral line, *i. e.*, in the place into which we assumed the rostrum of the phyllopod carapace moved. While in the *Balanomorpha* the remaining plates of the wall or parapet are derived from the bivalve phyllopod carapace, and the scuta and terga, which alone form the capitulum, are a wholly secondary development; in the *Lepadomorpha* the carina and rostrum have entered the capitulum and form the latter together with the terga and scuta. The capitulum of the *Lepadomorpha* would then appear to be homologous to the capitulum of the *Balanomorpha* plus a part of the wall (*viz.*, carina and rostrum)—a fact which in itself indicates an early separation of the two phyla.

As, however, both the *Balanomorpha* and *Lepadomorpha* probably will share the fate of most larger taxonomic divisions and be found to be polyphyletic in origin, it could be possible that balanomorphous forms originated in part directly from the phyllopod ancestors, as suggested by *Eobalanus*, and in part arose later on, whenever lepadomorphous forms became broadly sessile*. In the latter

* This view is also approached by Withers (1915, p. 118), who, after discussing the possibility of tracing the Verrucidae and the Olithamninae back to stalked forms in the Cretaceous, considers it very unlikely that the remaining "sessile" group among the recent cirripedes, the Balaninae or true balanids, can have any close relationship with the "sessile" Palaeozoic forms, adding, however: "It is much more probable that the

case, however, we fail to see the possibility of the transference of the carina and rostrum into the wall of the acorn-barnacle.

Finally, the writer would like to make a few remarks on the mode of preservation of the specimens of *Eobalanus*, since a correct view of this is necessary to avoid errors as to the original structure of the shell.

Mr. Withers has concluded that the wall of *Eobalanus* could not have consisted of upright or semi-upright plates, because in the fossils the plates are completely flattened and the parts apparently not in the least displaced or overlapping in any way. Considering that these specimens are preserved in black *Utica* shale where all fossils are reduced to completely flattened impressions—as are also the cephalopod shells to which *Eobalanus* is attached,—the general process of fossilization in these shales has to be taken into account. A study of the fossils that are there found, notably of the graptolites, shows, however, that they have all gradually been compressed into a flat plane or into a *plane projection* of their structure, more or less *pari passu* with the solution of their material, instead of being bodily pressed or crushed down, with the parts sliding over each other. As a result of this procedure, the plates are probably foreshortened—more or less according to their original angle of erection,—and have remained in contact without overlapping. It is this mode of preservation which also explains the slight discrepancies from a strictly bisymmetric arrangement of the plates which Mr. Withers points out, but which we fail to see in our drawings or in the material.

In the single Trenton specimen of *Eobalanus* the plates have been more disturbed, and the specimen is much less distinct, especially on one side, than those of the *Utica* species. The drawing of this specimen has been made by the writer with the camera lucida under water, and is probably as correct as it is possible to read the specimen in its unfavourable condition.

Summing up our conviction and point of view regarding

ancestors of the Balanus are to be sought for in the Cretaceous or early Tertiary rocks. Further, while among recent Cirripedes the sessile condition is undoubtedly due to a secondary modification of the pedunculate type, it must be kept in mind as a possibility that this may not have been the case among the more primitive forms of the Palaeozoic rocks. We can as yet form only a vague idea of the ancestral Cirripede, but there is no need to assume that it possessed a peduncle."

Eobalanus and the remainder of the Palæozoic cirripedes, we believe that they do not show any characters that would disqualify them from being regarded in part as direct ancestors, as *Eobalanus*, and in part as more or less closely related to the supposed ancestral forms of the Lepadomorpha, as *Turritepas*, *Plumulites*, and *Eopollicipes*. The burden of proof, considering the great time-interval between them and the Mesozoic and later forms and the correspondingly great differences in structure to be expected, rests not with those who consider them as cirripedes, but with those who deny their relationship to the cirripedes, and it will for this reason be a happy solution of the problem if Mr. Withers succeeds in showing them to belong to another class of animals.

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LX.—*A new Species of Platypodidæ from Pretoria, South Africa.* By Lt.-Col. WINN SAMPSON, F.E.S.

THROUGH the kindness of the Director of the Imperial Bureau of Entomology, I have been able to examine and describe the following new *Platypus* from Pretoria.

Platypus varius, sp. n.

Head black, the anterior third lighter in colour, prothorax a very dark brown. the elytra dark yellow. Front subconcave with an opaque dark shagreened surface, becoming paler on the anterior portion, sparsely punctured, especially towards the edges; the vertex of the head sharply defined by a narrow ridge extending from side to side and produced forwards centrally in front of the shining line dividing the upper opaque surface; the upper third of the front and the vertex sparsely punctured and hairy. Prothorax subquadrate, evenly punctured, the punctures being piliferous, especially laterally; a central median longitudinal groove commences close to the rather prolonged basal margin, extends nearly to the centre, and is continued to the anterior margin as an obscure carina; on each side of the basal half of the median groove there is a subelongate ferruginous patch with minutely hairy longitudinal strigose markings, somewhat similar to those found on species of the genus *Tesserocerus* and quite unlike the punctures common to the genus *Platypus*. Elytra with the third, fifth, and seventh interstices convex and raised above the others, the third having the base broadened and slightly transversely carinate; the alternate interstices narrow, very slightly raised and consequently obscure when viewed in certain lights; none of the interstices reach the extreme apical margin, which is slightly depressed and granulate; the uniseriate interstitial hairs become thicker and more irregular towards the apex.

Length 4·7 mm; breadth 1·8 mm.

CAPE COLONY: Transkei (*Stephens*); found boring into *Molletia sutherlandi*.

Type in the British Museum.

The coloured prothoracic patches and their strigose markings separate this species from any other known to me, but there are no other structural differences that would take the species out of the genus. The colour, especially of the prothoracic patch, varies slightly in some specimens, but none of them has the appearance of being immature.

LXI.—On a new Species of the Genus *Perionyx* (*Oligochæta*) from Tasmania. By J. STEPHENSON, D.Sc., Lecturer in Zoology, Edinburgh University.

Perionyx lacustris, sp. n.

Some time ago I received from Prof. Dendy a tube of *Oligochæta* worms which he had obtained in Tasmania. These prove to be a new species; and, since I am not likely to have the opportunity of examining further specimens from the Australian region, I give a separate description of the worms in the present short paper.

The worms were obtained at the Great Lake, Tasmania, in September 1914; they were found under stones in water at the margin of the lake. In life they were long and narrow, red in colour, and brilliantly iridescent in the water. I received fourteen specimens—not all mature,—all much softened, and several in two pieces.

Mature specimens measure 45–50 mm. in length and 3 mm. in maximum diameter. The colour of the worms in spirit is a deep purple dorsally and pale brown ventrally; the clitellum is lighter in tint. The number of segments in one of the specimens is 107. The worms are slightly depressed dorso-ventrally.

The prostomium is epilobous $\frac{1}{2}$, V-shaped, with a blunt angle pointing backwards. Dorsal pores begin in furrow 4/5.

The setæ are arranged in rings and are very difficult to see and count. The dorsal break (*zz*) is considerable, perhaps equal to about $3\frac{1}{2}z$; the ventral break (*aa*) is equal to rather more than $2ab$ anteriorly, but I could not satisfy myself as to its magnitude in the hinder part of the body. I counted 20 setæ in segment v., 22 in ix., 22 in xii., and 20 in xix.; but these numbers are all to be taken as only approximate.

The clitellum embraces segments xiv.–xvi. (=3); it is lighter in colour than the neighbouring segments.

The male pores are on segment xviii., on small papillæ one-third of the circumference apart; in some specimens there were however no papillæ, and the pores appeared to be about one-fourth of the circumference apart. The female pores were not visible. The spermathecal pores are small and inconspicuous, three pairs, in furrows 6/7, 7/8, and 8/9, one-fifth of the circumference apart.

Genital markings may occur in the region of the male and spermathecal pores. Thus in one specimen there is a pair of small transversely oval depressions, each surrounded by a lip, in front of the male pores over furrow 17/18, and a similar pair behind the male pores on the anterior part of

segment xix. In another specimen there are similar markings also over furrow 16/17. The markings in the spermathecal region were noted in only one specimen; they were similar to those in the male genital region, but larger, and were situated mid-ventrally on the hinder parts of segments vii. and viii. respectively, each taking up the posterior two-fifths of the length of the segment. All the markings have a somewhat eye-like appearance.

A number of small white opaque masses were seen adhering to the surface of the worms. When teased and examined under the microscope these were found to be composed of innumerable fine crystalline needles, which at first appeared to be insoluble in acetic acid; but when the preparation was looked at again after some time, the needles seemed to be slowly dissolving.

On examining the internal anatomy the septa were found to be all very much softened: apparently none are specially thickened. There are large lobular "septal glands" (aggregations of "chromophil" cells like those on the pharynx) on each side in segments vi. and vii.

The gizzard is small and cylindrical—distinctly vestigial—in segment vi. There are no calciferous glands. The intestine begins gradually, about segment xviii.

The last heart is in segment xii.

The excretory system is meganephridial; the nephridia have no visible end-sacs and end in the same line on each side.

Testes and funnels are free in segments x. and xi.; in these segments there is also much coagulum, simulating seminal vesicles. These organs are however present only in segments ix. and xii.; they are of considerable size, and cut up into lobes so as to be almost racemose; those of segment xii. meet dorsally in the middle line.

The prostates are of the *Pheretima*-type, of relatively considerable size, occupying segments xviii.–xx. and bulging forwards into xvii.; they are much cut up into lobes. The duct leads off from near the anterior end of the gland; it is very narrow, irregularly twisted, and shining; its general direction is transverse.

There are no penial setæ.

The spermathecae are three pairs; the ampulla is ovoid, the duct short, cylindrical, two-fifths as long and two-fifths as thick as the ampulla. There is a single diverticulum, which is given off from the cecal end of the duct; in shape it is a miniature replica of the main pouch—ovoid, with a short somewhat narrower stalk; the whole of the diverticulum is

LXII.—*On the Mammals collected in the Desert of Central Arabia by Major R. E. Cheesman.* By R. E. CHEESMAN and MARTIN A. C. HINTON.

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THE collection of mammals described in this paper was made by Major R. E. Cheesman in the Hasa Province and in the Jafura and Jabrin Deserts which form part of the Great South Desert of Arabia. The expedition was arranged by Sir Percy Cox, and was undertaken in response to an invitation from H.H. the Sultan of Nejd, with the object of investigating the desert-fauna of Central Arabia, which, owing to the inaccessibility of the country and the fanaticism of its inhabitants, was unknown. As might be expected in a district so widely different from the surrounding areas, many forms have proved to be new.

Generally speaking, the exceptionally pale desert-coloration is the most striking feature of the collection as a whole, and to match it to some degree one has to proceed far to the west, where, in the Aïr district of the Central Sahara, Capt. Angus Buchanan found some little time ago an extraordinarily pale assemblage of mammals. It is of interest, perhaps, to note that certain inferences as to the special habits of some of the numerous and competitive species of *Meriones* and *Jaculus*, found living together in close local association, derived independently from a study of the skull-structure, find confirmation in and in turn confirm the observations made in the field to a remarkable degree.

There is reason to suppose that the list given below would apply to the whole of the Great South Desert, there being, so far as is known, no physical barrier until the confines of the mountains, such as Aden and Yemen to the south and Muscat to the east, are reached, where markedly darker forms are known to replace the desert fauna. The entire absence of the mungoose, so plentiful in Iraq, and the replacement of the big dark Iraq hare by the small pale desert-coloured hare, give definite evidence as to the limits of range of each of the species concerned.

The types of all the new forms have been presented to the British Museum by Major R. E. Cheesman.

1. *Asellia tridens*, Geoff.

Hufuf. ♂. 5061, 5077, forearm 50, 51 mm.; ♀. 5076, forearm 49 mm.

These specimens were collected in December and are all in the pale fawn pelage; in size they agree with the typical subspecies from Egypt, and for the present, at all events, must be referred to *A. t. tridens*.

2. *Pipistrellus kuhli ikhwanius*, subsp. n.

Hufuf Town. ♂. 5062, 5069; ♀. 5067, 5068, 5078, 5148.

Distinguished amongst the subspecies of *P. kuhli* and from all other members of the genus, with the exception of *P. cori* (which is white), by its extremely pale colour.

Essential characters as in the typical subspecies. Size rather small (forearm 33–34, condylo-incisive length of skull 12.3 mm.).

General colour above light buff, darkened by the partly visible dark grey hair-bases. Underparts white. Membranes pallid. Interfemoral membrane densely clothed with short light buff hair above between the thighs and the base of the tail. Margins of wing-membranes whitish as usual.

Dimensions of type (measured in the flesh):—

Head and body 43 mm.; tail 33; hind foot 7; ear 10.

Skull: condylo-incisive length 12.3; zygomatic breadth 8.2; interorbital constriction 3.5; lachrymal breadth 5; breadth of brain-case 6.2; mastoid width 7.4; depth of brain-case in middle 4.5; upper tooth-row ($c-m^3$) 4.6.

Type. Adult male. B.M. no. 24. 8. 2. 1. Original number 5069. Collected by Major R. E. Cheesman at Hufuf Town on December 7th, 1923.

Hab. Hufuf, Hasa, Central Arabia.

Among the material used for comparison were two specimens obtained at Bahrain and three from Fao, which form part of the Cox-Cheesman collection, and are referable to *P. k. lepidus*, a pale and somewhat larger subspecies.

The Hufuf Pipistrelles are, however, very conspicuously paler, both as regards their fur and their membranes, than is any other form of *P. kuhli*.

3. *Otonycteris jin*, sp. n.

Hufuf. ♂. 5066, 5072, 5073, 5074, 5075.

Distinguished from the other known members of the genus by its larger size, larger and denser fur, pallid colour, and more inflated auditory bulks.

Size large (forearm 64–66 mm.; condylo-incisive length of skull 22.4–23; upper tooth-row 8.5–8.8; the corresponding

ranges in the other known species are—58–61, 20·9–22·3, 7·8–8·2).

Fur longer and much denser than in the other species; hairs of back about 10 mm. long. General colour of upper parts near the "pallid purple-drab" of Ridgway, lightened by the partly visible white basal portions of the hairs. Underparts pure white. Membranes and ears very pale.

Skull distinguished from skulls of *O. hemprichi* and *O. petersi* by its slightly larger size, heavier build, more inflated auditory bullæ, and larger teeth.

Dimensions of the type (measured in the flesh):—

Head and body 73 mm.; tail 57; hind foot 11; ear 40.

Skull-measurements: condylo-incisive length 22·9; zygomatic breadth 15·1; postorbital constriction 4·1; interorbital breadth 7·1; width of brain-case 11; width of occiput 11·7; median height of occiput 8; upper tooth-row (*c-m*) 8·5.

Type. Adult male. B.M. no. 24. 8. 2. 2. Original number 5073. Collected at Hufuf Town, Hasa, Arabia, on December 10, 1923, by Major R. E. Cheesman. Altitude 200 feet.

Hub. Hufuf, Hasa, Arabia.

Bats of this genus are extremely rare, and the five now received from Hufuf almost double its representation in the National Collection. They were met with only in Hufuf Town, and were there very uncommon.

4. ? *Paræchinus dorsalis*.

South Hasa: imperfect skin of a hedgehog, eaten by a fox. Judging from what is left of this specimen, the skin belonged to a species of *Paræchinus*, probably related to *P. dorsalis* of the Hadramout.

Major Cheesman saw the tracks of a hedgehog in the bushy sand-dunes of the Jafura desert, but did not find a specimen.

5. *Hyæna hyæna*, Linn.

Footmarks of hyænas, probably of this species, were seen as far south as Jabrin, where they were apparently plentiful, although no specimen was obtained. What they can find to live on when the tribes move away with their camels is a mystery.

6. *Canis pallipes*, Sykes.

Not uncommon at Hufuf and Jabrin, but only footmarks were seen. One came at night at Wadi Sahiba, and stole a

water-skin from the camp. The tracks showed that the wolf had come within a few inches of the sleeping inmates of the camp.

A specimen, obtained by La Personne in the Persian Gulf, in the Cox-Cheesman collection, is now alive in the London Zoological Gardens. Its coat is remarkable for its pale grey coloration.

7. *Mellivora* sp.

One ratel was surprised at close quarters, and unsuccessfully pursued in the trough of sand-dunes in the Jafura Desert.

8. *Gerbillus arduus*, sp. n.

Jabal Dharabin, Jafura Desert.

Zaiunqa, Hasa.

Most nearly related to *G. cheesmani*, but with relatively longer hind foot, slightly paler colour, and whiter tail.

General colour of upper parts dull sandy buff, lacking the warmer ochraceous tint seen in *G. cheesmani*.

Underparts, together with hands and feet, pure white. Tail with its upper surface very faintly suffused with cream-buff in its basal two-thirds; elsewhere white.

Skull and teeth essentially as in *cheesmani*, but the mesopterygoid fossæ shorter and broader, and the auditory bullæ (particularly their mastoid portions) a little more inflated.

Dimensions of type (measured in the flesh):—

Head and body 86 mm.; tail 124; hind foot 29; ear 12.

Skull: greatest median length 28·5; greatest diagonal length 29·2; condylo-incisive length 24·8; zygomatic breadth 15; interorbital breadth 5·3; breadth of brain-case 13·5; bimeatal breadth 15·3; nasals 10·4; palatal foramina 4·1; bullæ, longest diagonal 12·1, breadth at right angles to last (exclusive of meatal projection) 5·9; upper molars 3·5 (on crowns), 3·8 (alveoli).

Type. Adult male. B.M. no. 24.8.2.3. Original number 5162. Collected by Major R. E. Cheesman at Jabal Dharabin, Jafura, on February 14, 1924. Altitude 200 feet.

Hab. Jafura Desert, Central Arabia.

This beautiful little animal is strictly nocturnal. Closely related to *G. cheesmani* described from Iraq, it may later be shown to intergrade with the latter to the north-east; but its differences, the result of a more intense specialization for life in the desert, entitles it to be treated, for the present at all events, as a distinct species.

9. *Dipodillus dasyurus*, Wagner.

Delaqiya, Hasa. ♀. 5228.

MERIONES.

This genus is represented by four very distinct forms, distinguished from each other by characters of skull and pelage, which appear to be closely correlated in each case with special habits and the peculiar environment. Thomas* has already shown that "a single district may contain two or three species, all looking so alike as to be readily confused with each other, and yet readily distinguishable on close examination," and that the differences in the structure and development of the auditory bullæ afford the primary means of distinction, and enable us to separate the species into four groups. The present collection confirms these views of Thomas, while the field observations suggest an explanation.

The first species described below as *M. ismahelis* is a member of Thomas's α group closely related to *M. crassus* of Sinai. In it the bullæ are enormously developed, the coat very dense and long, and the colour very pale. It is confined to the sand-dunes desert, and is a strictly nocturnal animal. In this it agrees with *M. crassus*; for Hedenborg, who collected the original specimen of the latter species in Sinai, described it as "Nocturnus, prædatur ante lucem"†. The extravagantly developed bullæ appear to indicate, therefore, that in the darkness the animal has to rely chiefly upon its sense of hearing for protection from its enemies; while its unusually heavy coat is no doubt to be correlated with the low night temperature of the desert.

M. arimalius, the second species described below, is also related to the members of the α group, its closest affinities being apparently with *M. pelerinus* described from N.W. Arabia. This species inhabits the true desert, but is diurnal, scampering about on the hot sand and feeding at all times except during the hottest hours about noon. In it the bullæ are considerably less developed, suggesting that both sight and hearing are relied upon for defence. The coat is very thin and short, sufficient to protect its wearer from the sun, but not developed as a special defence against the night cold. The exceptionally pallid colour would seem also to be directly correlated with the diurnal habits.

The remaining two forms, treated as subspecies of *M. syrius*,

* Thomas, Ann. & Mag. Nat. Hist. ser. 9, vol. iii. p. 263 (1919).

† Sundevall, Kongl. Vetenskaps. Akad. Handl. 1842 p. 233.

are much less specialized. They are not inhabitants of the true desert, but are found along the borders of the cultivated fields at Hufuf, where lucerne is grown, and upon this plant they feed. At Hufuf there are two rivulets—one fed by the Khorasan spring, the other by the Khurdud spring,—and it is upon the banks of these rivulets that the lucerne is grown. Between the streams there is a bare limestone plateau about a mile wide, untenanted and uninhabitable by *Meriones*. It is of interest to find that each rivulet has its own peculiar form of *M. syrius*, the limestone plateau between being apparently an impassable barrier. One of the forms—*M. s. edithae*—has the richer colouring of true *syrius* combined with a much stronger skull and unusually robust body; the other—*M. s. evelynae*—has the skull and body-proportions of *syrius* combined with a pallid dorsal coloration.

10. *Meriones ismahelis*, sp. n.

Hufuf Oasis. ♂. 5120, 5121; ♀. 5103, 5104, 5116.

Jabrin Oasis. ♂. 5174.

A very pallid member of the *crassus* group, distinguished from *M. crassus* by its smaller size, finer coat, and paler colour.

Size medium (hind foot about 31 mm.; condylo-basal length of skull up to 36 mm. in adult ♂). Tail as in the other members of the group, short, about equal to head and body measurement.

Fur very fine, dense, and long; hairs on rump about 20 mm. in length. Colour of upper parts near "light buff" of Ridgway; underparts, together with the hands and feet, pure white. Upper surface of tail light buff like the back, not "cinnamon-buff" as in most other species of *Meriones*. Naked portions of soles light flesh-colour, instead of being black as in the *syrius* group.

Skull similar to that of *M. crassus* in general form, but slightly smaller. Auditory bullæ very large, with the mastoid, supra-tympanic, and premeatal portions greatly inflated, as in the related species.

Dimensions of type (measured in the flesh):—

Head and body 124 mm.; tail 124; hind foot (without claws) 31; ear 17.

For skull-measurements see table at p. 558.

Type. Adult male. B.M. no. 24.8.2.4. Original number 5121. Collected by Major R. E. Chcosman at Hufuf Oasis on January 7, 1924.

Hab. as above.

11. *Meriones arimalius*, sp. n.

Jabrin. ♂. 5194; ♀. 5195.

Jabal Agoula, Jabrin. ♂. 5205; ♀. 5201, 5206.

Most like *M. pelerinus* in skull, but outwardly distinguished by its pallid colour, short thin fur, and much longer white-tufted tail.

Size large (hind foot 37 mm., median length of skull 38.3), the hind foot and tail much longer than in *M. pelerinus*; tail considerably longer than, instead of being about equal to, the length of head and body.

Fur short and closely adpressed; hair on rump about 10 mm. in length. General colour paler than in any other known member of the genus. Crown of head and centre of back near "cream-buff" of Ridgway, fading on cheeks and flanks to "ivory-yellow." Underparts, together with the hands and feet, pure white; the hairs of the ventral surface white throughout. Tail, including its tuft, "ivory-yellow" throughout, with a few scarcely perceptible grey hairs in the tuft.

Skull like that of *M. pelerinus*, but with the auditory bullae somewhat less developed. In each bulla the mastoid portion is less swollen and terminates posteriorly but little behind the occipital plane; supratympanic and premeatal swellings a little less marked.

Dimensions of type (measured in flesh):—

Head and body 132 mm.; tail 163; hind foot 37; ear 18.

For skull-measurements see table at p. 558.

Type. Adult male. B.M. no. 24.8.2.5. Original number 5194. Collected by Major R. E. Cheesman at Jabrin on February 22, 1924.

Hab. as above.

This interesting species, the palest by many shades of all known jirds, is essentially an inhabitant of the sand-dunes of the Great South Desert of Arabia, and it was not found north of Jabrin. Its long, pale cream-coloured tail, lacking all trace of the cinnamon tint and black fringe so generally found in *Meriones*, sharply distinguishes it from all related species. This jird feeds exclusively on the bush (*Arthrocnemum fruticosum*) called "Gadha" by the Arabs, and its earths were only found on the gadha-covered dunes of soft white sand. It is a diurnal species, feeding throughout the day with the exception of the hottest hours about noon; and the smaller development of the auditory bullae, as compared with those of *M. pelerinus*, is no doubt correlated with the daylight activities of the animal.

12. *Meriones syrius edithæ*, subsp. n.

Khudud Spring, Hufuf. ♂. 5129, 5132; ♀. 5131.

A powerfully built subspecies, distinguished from the typical form by its longer and redder tail and heavier skull.

Fur sleek, moderately long; hair over rump about 14 mm. in length. Colour of upper parts warmer and richer than in *M. s. evelynæ*, near the "pinkish cinnamon" of Ridgway upon the crown of the head and back. Underparts pure white, the bases of the white hairs grey. Hands and feet white, washed with cream-buff above; naked parts of soles black. Tail "ochraceous salmon"; with terminal pencil of long black hairs.

Skull more massively built than in typical *syrius*, with stronger supraorbital beads and longer palatal foramina. Dorsal edge of masseteric plate thrown somewhat further forwards. Bullæ slightly more inflated.

Dimensions of type (measured in the flesh):—

Head and body 143 mm.; tail 181; hind foot 37; ear 18.

For skull-measurements see table at p. 558.

Type. Adult male. B.M. no. 24.8.2.6. Original number 5129. Collected by Major R. E. Cheesman at Khudud Spring, Hufuf, January 10, 1924.

Hab. as above.

13. *Meriones syrius evelynæ*, subsp. n.

Khorasan Spring, Hufuf. ♂. 5047, 5050, 5053, 5059; ♀. 5051, 5052.

An exceptionally pallid subspecies, with the tail much less rufous than usual.

Fur sleek. General colour of upper parts pale ochraceous buff; under parts pure white, the bases of the white hairs grey. Hands and feet white, inconspicuously blotched with pale ochraceous buff above; naked parts of soles black. Tail pale ochraceous buff above and below down to the commencement of the black dorsal fringe and terminal pencil.

Skull smaller than that of *M. s. syrius*, but essentially similar in general form and structure. Auditory bulks relatively larger and more globosely inflated.

Dimensions of type (measured in the flesh):—

Head and body 144 mm.; tail 156; hind foot 34; ear 18.

For skull-measurements see table at p. 558.

Type. Adult male. B.M. no. 24.8.2.7. Original number 5050. Collected by Major R. E. Cheesman at Khorasan Spring, Hufuf, Hasa, Arabia, on November 28, 1923.

Hab. as above.

14. *Mus musculus gentilis*, Brants.

Hufuf Gardens. ♀. 5125.

Not very plentiful, and more often seen in the gardens than in the town.

15. *Nesokia burtoni*, Thos.

Oqair, Hasa. ♂. 5012.

16. *Rattus rattus*, Linn.

Hufuf Gardens. ♂. 5126, 5127.

These have brown backs and white bellies, and represent the wild original form of the "black rat."

Major Cheesman did not see one in the town. At Hufuf it was a garden animal, living in burrows near the running streams and making stick-and-leaf nests in the trees.

17. *Jaculus florentiae*, sp. n.

Jabal Aqula, Jabrin. ♀. 5207.

Jafura Desert. ♀. 5123.

Distinguished from all its geographical allies by its large size, long tail, and paler colour.

Size large (hind foot 55-60 mm.), nearly as in *J. syrius*. General colour very pale. Top of head and back near "pale pinkish buff" of Ridgway. On the rump some of the hairs have dark tips, which form peculiar shade-markings in the general pattern and are continued over the flanks to the white sides. Underparts, together with hands and feet, pure white. Toes heavily booted with long, stiff, white hairs, as usual. Tail pale, pinkish buff above, white below up to the tuft, which is long and white; there is a small patch of "vinaceous slate" where the buff and white meet.

Skull and teeth nearly as in *J. syrius*.

Dimensions of the type (measured in the flesh):—

Head and body 114 mm.; tail 176; hind foot 55; ear 22.

Skull: greatest median length 31.9; greatest diagonal length to back of auditory bullæ 31.5; greatest breadth across face 21.8; interorbital breadth 11; bimeatal breadth 22.6; interorbital foramina, height 6.7; breadth across the two foramina 15; upper molar series (crowns) 4.9.

Type. Adult female. B.M. no. 24. 8. 2. 8. Original number 5207. Collected by Major R. E. Cheesman at Jabal Aqla, Jabrin, on Feb. 24, 1924.

Hab. Jabrin, Alrimal, and Jafura Deserts, Central Arabia. Altitude 200 to 400 feet.

The jerboa of the Jabrin Desert is distinguished as being the palest known member of the genus, more pallid even than *J. aïrensis*, the form inhabiting the district of Aïr in the Western Sahara. *J. loftusi*, described from Mohommara, Persia, and its subspecies *J. l. vocator*, described from Seeb, 22 miles N.W. of Muscat, are smaller and darker; while *J. j. syrius*, described from Karyatein in the Syrian Desert, has a coat which contains brown and greys almost too dark to permit it being described as having a desert-coloration.

The study of the new Arabian material leads us to think that *syrius* and *vocator*, described by Thomas as subspecies of *J. jaculus* and *J. loftusi* respectively, will eventually have to be treated as full species.

In the north-east of Arabia *J. florentiae* reaches the coast at Koweit, thus interrupting the range of *J. loftusi*. This coastal representative is slightly darker than the typical form of the central deserts, and it may therefore be described as a subspecies as follows:—

18. *Jaculus florentiae oralis*, subsp. n.

Essential characters and size as in *J. florentiae*. Colour noticeably darker, though conspicuously lighter than in either of the former subspecies of *loftusi*.

Dimensions of type (measured in the flesh):—

Head and body 120 mm.; tail 197; hind foot 56; ear 24. No skull.

Type. Adult male. B.M. no. 7. 11. 22. 27. Original number S.K. 6. Collected and presented to the Museum by Major S. Knox at Koweit, April 22, 1907.

Hab. Coastal region of N.E. Arabia.

A specimen in the Cox-Cheesman collection (no. 1612) from Zobeir matches the two examples collected by Major Knox at Koweit very exactly.

19. *Lepus omanensis cheesmani*, Thos.

Jabal Aqla, Jabrin. ♂. 5169, 5204.

Jafura Desert. ♀. 5163.

Skull-measurements of Meriones (in millimetres).

	<i>ismakliis.</i>		<i>crassus.</i>	<i>pelerinus.</i>	<i>cinalius.</i>	<i>syrius syrius.</i>		<i>s. edithae. s. exelynae.</i>
	Hufuf.	Jabrin.	Simai.				Zobeir.	
	♂. 1 ♀.	♂.	♂. 20 8 6 13	♂. 10 3 12 5	♂.	♂. 3 7 2 2	♀. 1 ♂.	♂.
	5121	5104.		Type.	5194.	Type.	1020. 1022	5129.
	Type.				Type.			Type.
Condyllo-basal length	35.2	35.7	36.9	30.2	30.1	39.8	34.5	36.7
Median length	35.1	33.3	39.5	38.8	38.3	42.4	37.2	40.8
Diagonal length	40.5	41.1	42.6	41.3	39.7	43.2+	42.1	41.1
Zygomatic breadth	22	22.5	22.8	21.2	20.5	24.2	20.4	24.3
Interorbital breadth	6.3	5.6	6.3	6	6.7	7.9	6.2	7.7
Bimastal breadth	23.3	20.8	24.8	22.8	22	22.9	21.7	23.5
Palatal foramina	7.1	6	7.2	7.2	6.2	7.9	6.6	7
Dental length	17.5	15.5	18.2	18.3	17	19.4	17.4	18.4
Upper molar series (base of crown) ..	5	4.9	5.4	5.3	5.1	5.5	4.8*	5.3
Bullae : diagonal length	16.3	15.1	18	16.8	16	16.3	16.5	15.2
" " : mental length	15.2	13.8	17.3	15.1	13.5	19.4	14.8	13
" " : supra-mental trigon. c. per. tu.	6	5.7	6.7	6	6	5	6.1	4.7
" " : " " " "	4.4	4.7	5.5	5.1	3.1	2.8	3.8	2.3

* Much worn teeth.

LXIII.—Some Notes on the Genus *Apus* (Crustacea
Branchiopoda). By ROBERT GURNEY.

THE separation of species within the genera *Apus* and *Lepidurus* is a matter of quite unusual difficulty, since there is much variation, and, as a rule, the only characters on which separation can be based are small and ill-defined. Descriptions founded on single specimens, as they have sometimes been, or unaccompanied by accurate illustrations, are therefore unreliable, and anyone who has had to do with the identification of species will agree as to the difficulties of the task.

Excluding certain species which have already been abandoned as synonyms, there remain about twenty-five species of *Apus* described, and of these some, such as *A. domingensis*, Baird, *A. guildingi*, Thompson, and *A. obtusus*, James, are insufficiently described and unrecognizable, while two—*A. abyssinicus*, Rüppel, and *A. madagassicus*, Thiele—should probably be omitted as synonyms of *A. sudanicus*, Brauer, and *A. sakalavus*, Nobili, respectively. A revision of the whole genus, founded on re-examination of adequate material, is most desirable, but a task of no small difficulty.

The following notes on two species may be of some help in clearing up some doubtful points.

Apus numidicus, Grube.

Syn. *A. dispar*, Brauer.

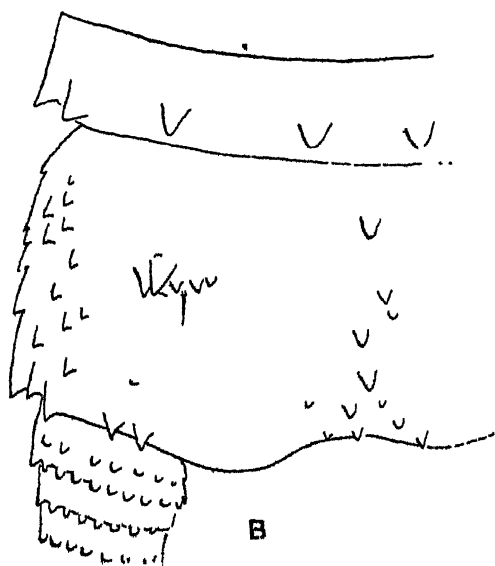
A. dukianus, Day.

A. numidicus, var. *dybowskii*, Brahm ?.

Having recently had the opportunity of examining the type-specimen of *A. dukianus*, Day, which is preserved in the British Museum*, I have found it necessary to collect such facts as is possible with regard to the variability of *A. numidicus*, with which I believe Day's species to be identical.

I had previously been of the opinion that more than one species had been confused under the name of *A. numidicus*, but it appears, on further consideration, that the limits of variation are wide, and that no distinction is at present possible except, perhaps, with regard to the form described by Sais from S. Africa. It is possible that certain other species, such as *A. somalicus*, Wedenissow, may eventually have to be included in it.

* I am indebted to Dr. W. T. Calman for permission to examine this specimen.



Apus dubianus, Day, type-specimen, ♂.

A. Ventral view of part of telson and right furcal ramus.

B. Dorsal view of left half of telson.

Such descriptions as have been given of *A. numidicus* are rather incomplete, with the exception of that of Prof. Sars*.

The specimens which I have had for study and which I attribute to *A. numidicus* are these:—

- (1) One male from Ain Oussera, Algeria, collected by M. Seurat.
- (2) Numerous specimens from a rain-pool 30 miles west of Dongola.
- (3) Numerous dried specimens of doubtful provenance, but said to have been brought by a native from near Medina in Arabia (British Museum collection).
- (4) A single male from Khartoum (British Museum).
- (5) The type-specimen (male) of *A. dukianus*, Day.

The characters of these specimens may be summed up as follows:—

(1) Carapace flattened, semitransparent, nearly circular in outline, and about half or less than half the total length of the body. Posterior sulcus deep, margined by small denticles which are usually numerous (36–44), but larger and fewer in the specimens from Medina (25). The carina continuous from the anterior transverse furrow, but not projecting as a spine into the posterior sulcus. Carina and surface of carapace smooth, but usually the posterior ventral margin denticulate.

(2) Nuchal organ large, triangular.

(3) A variable number of somites left uncovered by the carapace, more in the male than in female. The number is least (22) in specimens from Medina, and varies from 28 to 35 in the others. Among the specimens from Dongola the number ranges from 18–31 in female and 29–33 in male.

(4) Number of legless somites very constant—11 in female and 13 or 14 in male (including last somite or telson).

(5) The telson is approximately twice as wide as it is long, but variable in this respect. In the specimen from Khartoum proportion of length to width is 1:2.6, whereas it is almost exactly half in the Algerian specimen and 1:1.8 in those from Dongola.

Dorsal surface without conspicuously large teeth (as seen in *A. cancriformis*), but with median and lateral groups of teeth of varying size, with bare spaces between the groups. Teeth encircling base of furcal rami larger than the rest, 3 to 5 being visible dorsally.

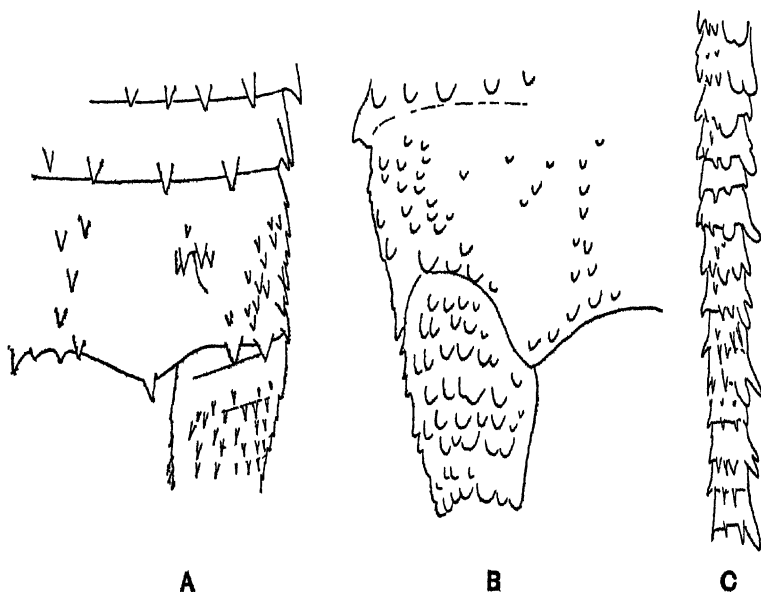
Ventral surface with small scattered denticles, usually leaving a narrow median space and a space on inner side of cerci bare.

* Arch. Math. Nat. xx. (1898).

(6) Furcal rami. These are usually more or less broken, and for this reason I cannot give any definite statement as to their relative length; but they appear to be of about the same length as the carapace. In the female they are armed with rings of small spines, but in the male they are quite different, the spines being replaced on the ventral side by conspicuous scales or knobs.

I do not find this point dealt with in any reference to the species, neither has a sexual difference in this respect been

Fig. 2.



Apus numidicus. Modina

- A. Telson, dorsal view (female).
- B. Telson, ventral view (male).
- C. Part of furcal ramus of male.

established in any other species. Thiele, mainly on the ground of the different structure of the furcal rami, separated a single male found in company with the female of *A. sakalavus* as a distinct species—*A. madagassicus*,—but, in view of the fact that the difference is simply a sexual one in *A. numidicus*, there can be no doubt that Thiele's male belonged to *A. sakalavus*.

(7) The first leg alone among the appendages affords

TABLE I.—*Measurements of Apus numidicus from various Localities.*

	<i>A. numidicus</i> . Algeria. ♂.	<i>A. numidicus</i> . Medna. ♀. ♂.	<i>A. numidicus</i> . Khartoum. ♂.	<i>A. numidicus</i> . Dongola. ♀. ♂.	<i>A. dukianus</i> . Type. ♂.
Carpapace: length, median	12 mm.	8 10	12.5	10.6 12	14
" width	15 mm.	7 ..	12.5	10 13	15.5
Total length, median	31.5 mm.	15 20	31	29 22	37.5
Furcal rami (approximate)...	15 mm.	10 10	11.5	15 15	17
Longest flagellum of leg 1	11 mm.	....	9.5	.. 7	10.4
Somites uncovered	31	22 22	33	29 31	35
Legless somites.....	14	11 13-14	14	11 13-14	14
Total somites .....	....	....	42	.. 38	....
Total number of legs .....	....	....	53	.. 49-51	....

specific characters. It may be that specific differences may be proved to exist in the structure of other appendages, but they have not hitherto been established. The longest flagellum of the first leg extends to, or slightly beyond, the end of the shield, and the relative length of this flagellum, though differing somewhat as between the two sexes, seems to be a fairly reliable specific character, not liable to great variation.

(8) The posterior somites are armed with the usual rings of teeth, and of these 8-10 are visible dorsally and project slightly beyond the edge of the somites. Ventrally they are more numerous and smaller. The somites are generally bare except for this ring, but in the type of *A. dukianus* and in the specimens from Medina there are also a few scattered denticles.

Importance should not be attached to the question whether the spines project beyond the edge of the somite, since this depends to some extent on the degree of contraction of the animal.

The specimens from South Africa so fully described by Prof. Sars under the name of *A. numidicus* differ from those which I have examined in two respects:—

(1) The furcal rami are alike in the two sexes, being distinctly annulated, each segment bearing two rings of fine bristles.

(2) The telson appears to be entirely smooth below and almost smooth above.

I have seen a very small specimen from South Africa in the collection of the British Museum, which was named by Prof. Sars as *A. numidicus*, and was unable to detect, with a low magnification, any spines on the ventral surface of the telson.

Where differences between species are so small, importance has to be attached to such a character as this, and it is probable that the South African form should be distinguished as a separate species.

The facts given by Braehm with regard to his *A. numidicus*, var. *dybowski*, do not permit of an independent judgment being formed, but it seems possible that it may really belong, not to *A. numidicus*, but to *A. asiaticus*.

The Genus Proterothriops, Ghigli.

This genus was founded by Ghigli* in 1921 to include

* Atti Soc. Ital. Sc. Nat. lx. p. 161.

the species of *Apus* centring round *A. numidicus* as the type. The chief characters of the genus are as follows:—

(1) Dorsal shield short, thin, and covering but little of the body.

(2) Sulcus of shield with numerous small denticles.

(3) Furcal rami with large blunt spines.

(4) Telson with groups of small spines, but without large spines.

(5) Nuchal organ large and triangular.

The species referred to the genus were *A. numidicus*, Grube, *A. granarius*, Simon, *A. longicaulatus*, Leconte, *A. lucasanus*, Packard, and *A. neoberryi*, Packard.

If it were a question solely of a comparison of *A. numidicus* with *A. cancriformis*, a generic separation would be possible; but I do not think the genus can be maintained when all the species are taken into account. *A. lucasanus*, for example, of which I have been able to examine specimens very kindly given to me by the United States National Museum, certainly does not come within Ghigli's definition, and I do not consider that any of the characters given can be taken as applying to a well-defined group of species.

(1) The form of the carapace is not distinctive, depending to some extent on the state of preservation, and differing sometimes in the two sexes—e. g., *A. lucasanus*, *A. gracilis*. The number of somites exposed is also a rather uncertain character, and some species in which a large proportion of the body is uncovered should, according to other characters, be grouped with *A. cancriformis*—e. g., *A. australiensis*.

(2) The size and number of teeth on the posterior margin of the carapace are not distinctive. For example, in *A. lucasanus* they are as large as in *A. cancriformis*, and number in three specimens 25, 27, 28.

(3) The arrangement and size of the spines on the telson seems to afford an excellent character as between *A. cancriformis* and *A. numidicus* and certain others, such as *A. asiaticus*, Gurney; but in *A. lucasanus* the dorsal surface is armed with a few very large spines, just as it is in *A. cancriformis*.

(4) The armature of the tail-filaments may be a good character, but we do not know enough about it. In *A. lucasanus* and in some specimens of *A. numidicus* the filaments differ in the two sexes, those of the female being briefly and those of the male armed, at least at the base, with scales or knobs.

(5) *A. australiensis*, Spencer and Hall, seems to belong in some respects to the *A. numidicus* section, but has, according to Spencer and Hall, a round nuchal organ.

It may prove possible, when the species of Apodidæ are surveyed as a whole, to establish generic distinctions within the genus *Apus*, but there is little advantage in doing so, and the information available at present certainly does not suffice. Even between the accepted genera of *Lepidurus* and *Apus* the difference is so small that the abandonment of the former genus has been recommended (Brachm, 1893*). This genus is, however, definable, and may conveniently be retained, but it is to be hoped that the genus *Apus* will not be split up without a very thorough examination and consideration of the limits of individual and local variation.

Apus asiaticus, Gurney.

In an account of Crustacea collected in Mesopotamia† I referred some specimens of *Apus* taken at Bagdad to Sars's *A. granarius*, to which, however, I thought it necessary to attach a new name, considering that Sars's form was not the same as that of Simon. Having received from the late Dr. Annandale a number of specimens of *Apus* taken in India, it has been necessary to go again into the question of the identity of this form, since I cannot find any differences sufficient to distinguish the Indian form from that of Bagdad.

These specimens were taken by Prof. J. P. Mullan at Panchgani, Satara District, Bombay Presidency, and were damaged and partly dried by the breaking in transit of the bottle in which they were contained.

The accompanying table (p. 567) gives comparative measurements which show the close agreement of the various forms.

The Indian specimens agree in all essentials with those from Bagdad and Central Asia, except that the longest flagellum of the first leg is slightly longer, nearly reaching the end of the carapace. The nuchal organ is also rather more narrowed in front.

The close resemblance of this species to *A. numidicus* has already been commented on by Prof. Sars, and, so far as I can see, there are only two characters by which the species can be separated:—

- (1) The replacement of the hairs by knobs or scales on the ventral surface of the furcal rami in the male of *A. numidicus*.
- (2) The more numerous denticles on the dorsal face of the telson in the latter.

The presence in *A. asiaticus* of small denticles on the ventral surface of the posterior somites is not distinctive,

* Zeitschr. wiss. Zool. lvi. pp. 165-187.

† Journ. Bombay Nat. Hist. Soc., July 1921, pp. 85-93.

TABLE II.—Measurements of *Apus asiaticus*, Gurney.

	<i>A. granarius</i> , Sars. Central Asia. ♀. ♂.	<i>A. asiaticus</i> . Bagdad *. ♀. ♂.	<i>A. asiaticus</i> . India *. ♀. ♂.	<i>A. asiaticus</i> . India. ♂.
Carapace: length, median	13 mm. 12	13.5 13.9	13 13	22
" width	11 mm. 12	11.8 12.3	9 12	19
Total length, median	31 mm. 35	26.5 33	23 31	45
Furcal rami	18 mm. 14	16 17.6	15 13	Broken.
Longest flagellum of leg 1	Much shorter than carapace.	8 8 Shorter than carapace.	Shorter than carapace.	19 Longer than carapace.
Somites uncovered	32 33	24 27	24 23	24
Legless somites	10-11 12-14	10-11 12-14	10-11 12-14	13
Total somites	42 41-42	....	37 ..	....
Denticles on posterior sulcus ..	Minute.	40 39	.. 43	44

* Average measurements.

since these denticles may be present in *A. numidicus*. The difference in the length of the flagellum of the first leg is hardly great enough to be relied upon, since it is as long in some of the Indian specimens as it is sometimes in *A. numidicus*.

The greater length of this flagellum in some Indian specimens than in those from Bagdad rather tends to bridge the gap between *A. asiaticus* and *A. granarius*, Lucas; but I think that, for the present, it is best to regard the two forms as distinct.

The distribution of *A. asiaticus* is therefore as follows:—

(1) Central Asia: Chingau Mountains (*Sars*).

(2) Bagdad (*Gurney*).

(3) Bombay Presidency.

(4) It is possible that the species of *Apus* recorded by Vredenburg* from Baluchistan belongs to this species.

LXIV.—*New Species of Nematocerous Diptera from Fiji and Trinidad.* By F. W. EDWARDS.

(Published by permission of the Trustees of the British Museum.)

THE majority of the insects here described were received through the Imperial Bureau of Entomology from Messrs. Veitch and Greenwood, who collected them in Fiji. One species sent by Dr. C. L. Withycombe from Trinidad is also included at the request of the collector and for comparison with the related Fijian form. All the types are preserved in the collections of the British Museum (Natural History).

Mycetophilidæ.

Sciara distigma, sp. n.

♀. *Head* orange, a small dark ocellar spot. Eye-bridges small, separated by about the width of six facets. Ocelli placed well behind the eyes. Palpi dark brown. Antennæ with the scape orange, flagellum black, segments about twice as long as broad. *Thorax* shining orange, mesonotum with a pair of oval black spots, widely separated, about the middle; hairs small and inconspicuous. *Abdomen* black, lateral membrane reddish. Cerci roundish. *Legs* orange, tarsi darkened. Hind tibiae with indefinite apical comb. First segment of hind tarsus less than half as long as the tibia. *Wings* deep brown. Branches of *M* and *Cu* setose. Costa reaching three-fourths of the distance from *R*₅ to *M*₁; *R*₁ ending just beyond base of median fork, very slightly shorter

* Journ. Asiat. Soc. Bengal, n. s., i. p. 83 (1906).

than *R*. Stalk of cubital fork distinct, but upper branch faint at base. Halteres entirely black.

Length of body 5-6 mm. ; wing 4.5-5.5 mm.

Fiji: Nausori, v. 1921 (*R. Veitch*), type ♀. Loloti, 19. xii. 1920 (*Greenwood*), 1 ♀.

An extremely distinct species by the colour of the thorax.

Phorodonta pacifica, sp. n.

Head dark brown, dusted over with dark grey. Eyes touching above antennæ. Ocelli close behind the eye-bridge. Palpi black. Antennæ with the scape pale ochreous, flagellum black ; in the male the antennæ are almost as long as the body, segments with distinct necks, pubescence about as long as the diameter of the segments ; in the female the antennæ are shorter, the segments without distinct necks and with shorter pubescence. *Thorax* ochreous, mesonotum somewhat darker, and with two short sublateral brown stripes, which are more distinct in the female ; upper part of anepisternites, lower part of sternopleurites, and the whole pleurotergite and postnotum dark brown. Mesonotal bristles black, the dorso-central series in single rows, short. *Abdomen* blackish, short and plump in the female. Male hypopygium ochreous, claspers rather long, without spines, but densely set with black bristles at the tip. *Legs* ochreous, tarsi darkened, tips of trochanters black. Claws with two strong teeth close together in the middle (visible under high magnification). *Wings* clear. Branches of media and cubitus setose, also the end of the stem of the media. Costa reaching halfway from tip of *Rs* to that of *M*₁ ; *R*₁ shorter than *R* and ending well before the base of the median fork in both sexes ; *r-m* longer than the basal section of the media ; cubitus forking below or immediately beyond the base of the stem of the median fork. Halteres with ochreous stem and black knob.

Length of body about 3 mm. ; wing 3-3.3 mm.

Fiji: Lautoka, 11. iv. 1923 (*W. Greenwood*) ; 4 ♂, 4 ♀.

The genus *Phorodonta* (*Odontonyx*) was founded for three species of *Sciara* with toothed claws, the genotype being chosen by Coquillett as *S. niger*, Wied. I do not know this species, but I find that the European *S. flavipes*, Mg., has claws similar to that figured by Rübsaamen for *S. niger*. The present new species is evidently closely related to *S. flavipes*, and the two may probably be referred to *Phorodonta*, if this genus is to be maintained as distinct from *Sciara*. Another species belonging to this group is *S. filipes*, Walk. (New Guinea), and probably a few others described

as *Sciara* will be found to belong here. A noteworthy feature of all these species is the distinct elongation of the coxæ, which are almost as long as in the *Mycetophilinae*.

Leiomyia (*Rhymoleia*, subgen. nov.) *jijiana*, sp. n.

♀. *Head* shining black; face and a small area above the antennæ yellow. Palpi pale yellowish. Antennæ with the scape yellowish; first five or six flagellar segments darkened apically, the rest all dark. *Thorax* entirely shining black. Scutellum with two long bristles; outer pair very short and inconspicuous. *Abdomen* entirely black, less shining than the thorax. *Legs* uniformly ochreous, except for a black spot at base of hind coxæ; bristles and spurs ochreous. *Wings* slightly brownish-tinged; a very slightly darker shade on the apical half. Lower branch of media not reaching margin, and curved upwards. Halteres ochreous.

Length of body 2.8 mm.; wing 3.3 mm.

FIG: Loloti, 18. ix. 1921 (*W. Greenwood*), 1 ♀.

The new subgenus differs from *Leiomyia* (*Glaphyoptera*), n. str., as follows:—Lateral ocelli absolutely contiguous with the eyes. Antennæ ringed. *Sc* evanescent at the tip, *Sc₂* placed before its middle. The following previously described species belong here:—*Leia maculicoxa*, End. (= *Rhymosia fascipes*, Brun.), *L. seychellensis*, End., *Rhymosia flavo-limbata*, Brun., *R. annulicornis*, Brun., and *R. humeralis*, Brun. From all these the new species differs in its entirely black body-colour.

Delopsis greenwoodi, sp. n.

♂. *Head* shining ochreous-brown. Palpi and first few antennal segments ochreous, rest of flagellum dark brown. *Thorax* moderately shining black, with a narrow ochreous collar on the mesonotum; pubescence and bristles dark. Anepisternal suture very short and incomplete. Pleurotergite and pteropleurite very small, together not a quarter as large as the fused anepisternite and sternopleurite. *Abdomen* blackish dorsally, with one narrow transverse yellowish band at the base of tergite 3; venter and sides of tergites also yellowish. *Legs* ochreous, tarsi and tibial bristles and spurs dark. Mid-tibial bristles: 5 dorsal, 0 subdorsal, 1 external, 2 long ventral, 0 internal (those at tip excluded). Hind tibial bristles in two rows only. *Wings* greyish, more ochreous towards costa, unmarked. Costa extending very slightly beyond tip of *Rs*. Halteres ochreous.

Length of body 2.8 mm.; wing 2.2 mm.

FIG: Loloti, 14. iv. 1922 (*W. Greenwood*), 1 ♂.

This resembles *D. collaris* (End.), *D. brunettii*, Edw., and especially *D. flavohirta*, White, very much in colour, differing in the chaetotaxy of the mid-tibiae and other points. In *D. flavohirta* the mid-tibial formula is 5. 4. 3. 4. 1, in *D. collaris* 5. 0. 3. 3. 1.

Scatopsidæ.

Swammerdamella albinana, sp. n.

Closely resembles the European *S. brevicornis* (Mg.), differing as follows:—Antennæ a little longer, with rather longer pubescence. The produced tip of the last abdominal tergite of the male forms a nearly equilateral instead of a flattened triangle. Tarsi wholly whitish-ochreous, instead of black. Second costal division rather longer, one-third instead of only one-fourth as long as the first.

FIJI: Lautoka, 2. v. 1919, "in great swarms on laboratory windows" (W. Greenwood and R. Veitch).

Swammerdamella approximata, sp. n.

Differs from the European *S. brevicornis* (Mg.) as follows:—Size rather smaller (length, in alcohol, ♂ barely 1 mm., ♀ 1.3 mm.). Tarsi white, except for the last one or two segments, which are blackish. Second costal division extremely short, veins R_1 and R_s being almost in contact.

TRINIDAD: St. Augustine, 22. i. 1924 (Dr. C. L. Withycombe), numerous ♂ ♀ (co-types).

This can hardly be *S. pygmaea* (Lw.), as the median fork is quite as short and of the same shape as in *S. brevicornis* (Mg.).

Tipulidæ.

Libnotes veitchiana, sp. n.

♂. Head greyish. Front narrow. Antennæ, palpi, and proboscis blackish; flagellar segments shortly oval, with short verticils and short necks. Thorax dull brownish dorsally, the præscutum with three darker brown stripes. Pleuræ shining ochreous-brown, apparently unmarked. Abdomen blackish, except the hypopygium, which is mainly brownish ochreous. Only one pair of claspers, which is broad, rather flat, ending in one or two small points. Sidepieces with long subapical ventral projections, which are curved upwards, somewhat narrowed before the tip, the end blackened and somewhat spatulate. Legs brownish, coxæ and tips of femora pale ochreous. Wings clear, except for the small, oval, light brownish stigma. Venation as in *L. fijiensis* (Alex.), except that r is longer and more curved. Halteres with brownish knob.

Length of body 4 mm.; wing 5.5 mm.

Fiji: Labasa, vii. 1922 (*R. Veitch*), 1 ♂.

Allied to *L. fijiensis* (Alex.) (described as *Teucholabis*), but is quite distinct by the clear wings and rather differently shaped claspers. The only other species known to me with a similar hypopygium is one which I have described from the island of Buru.

Styringomyia fumosa, sp. n.

♀. *Head* blackish brown. Anterior pair of frontal bristles fairly long, but the rest much shorter. Palpi and antennæ black. *Thorax* mostly shining blackish, but the anterior part of the præscutum as well as the pronotum dull and partly light brownish. One lateral bristle on the posterior part of the pronotum. Humeral and discal bristles very short, mid-scutal bristles also short, not much longer than the discals; lateral scutal pair long, but not flattened. *Abdomen* wholly black. Ovipositor of unusual structure for a member of this genus; the anal cerci long and pointed, with large leaf-like ventral vertical expansions; seventh sternite square-ended and not at all enlarged. *Legs* black. Femora with a yellowish preapical ring, conspicuous only on the hind pair. Base of front femora and of the four anterior tibiae yellowish; faint traces of a yellowish ring beyond the middle on the four anterior tibiae. Bases of segments of front and mid-tarsi, also tip of first front tarsal segment, obscurely yellowish; first four segments of hind tarsi entirely light yellow. *Wings* smoky, darker towards costa on apical half of wing, but without any traces of darker spots. Veins all dark; cell M_1 sessile; *Ax* only slightly curved down at tip. Halteres black.

Length of body 4.2 mm.; wing 4 mm.

Fiji: Mountains, Lautoka, 11. iv. 1920 (*W. Greenwood*), 2 ♀.

More nearly resembles the African *S. obscureriveta*, Edw., than any described Oriental species, but quite distinct, especially by the structure of the ovipositor.

Simuliidæ.

Simulium laciniatum, sp. n.

♀. *Head* dull blackish grey, clothed on both the face and frons with golden pubescence and short dark hair. Antennæ moderately stout, 11-segmented, first five or six segments dull reddish, the rest dark brown. Palpi black. *Thorax* dull blackish or dark brown, integument quite unmarked.

pubescence, not very dense; the whole of the membranous patch on the pleuræ clothed with similar pubescence. *Abdomen* dull blackish, dorsum mainly clothed with dark brown pubescence; sides and a narrow posterior border on the second and fifth tergites with golden pubescence. *Legs* with the femora brown, on the hind legs with the ends darkened; tibiæ with the basal two-thirds ochreous, the ends darkened, on the hind legs practically black and contrasting with the pale basal part; tarsi black, except that on the hind legs the basal three-fourths of the first segment is pale ochreous. On the pale parts of the legs the pubescence is ochreous, on the dark parts dark brown. Front tarsi almost cylindrical, with the usual long hairs on the first and third segments. Prolongation of the first hind tarsal segment unusually large, being as deep as the segment itself and reaching to the end of the second segment, this latter being rather shorter than usual and distinctly excised at the base. Claws of moderate size, with a rather large but blunt and not strongly produced hump at the base. *Wings* normal.

Length of body about 2.5 mm.; wing 3 mm.

FIJI: Lautoka, Mt. Evans, 2500 feet, 11. v. 1919 (*W. Greenwood*), 2 ♀ (incl. type), and 18. vi. 1922, 1 ♀.

This species appears very distinct by the hind tarsal structure. In most or all of the European species, and in most others examined by the writer, the prolongation at the tip of the first segment is smaller and not more than half as deep as the segment itself.

Chironomidæ.

Chironomus (*Xenochironomus*?) *candidibasis*, sp. n.

♂. *Head* dark brown. Eyes approximated. Frontal lobes absent. Antennæ dark brown, first two or three flagellar segments lighter; last (twelfth) segment a little over twice as long as the rest of the flagellum. Palpi long, pale yellow. *Thorax* dark brown, mesonotum entirely shining, with three nearly confluent black stripes, between which are single rows of hairs; scutellum with 8-10 stiff bristly hairs round the margin. *Abdomen* green; tergites 2-5 each with a large blackish spot near the base; segments 6-8 dull black. Hypopygium yellowish; ninth tergite truncate, without point; claspers with fine curved hairs on the inner side at the tip; lower appendage of side-piece rather long but stout, with long curved hairs. *Front legs*: femora greenish, the tip rather broadly black; tibiæ somewhat swollen, black, the basal third pure white; tarsi black, the first segment with a broad white ring which leaves the base

narrowly black. Tarsal index 1.5. *Middle legs*: femora entirely greenish; tibiae greenish, the tip narrowly black; first tarsal segment greenish, with a blackish ring in the middle; rest of tarsus black. *Hind legs* coloured as front legs, except that the first tarsal segment is nearly all white, only the tip being narrowly black. Pulvilli apparently undivided, over half as long as the claws. *Wings* mainly hyaline; a broad black band beyond the middle extending from vein R_{4+5} to the hind margin, where it is narrower; a large black patch, divided longitudinally by a pale line, below the middle of the main stem of *Cu*. R_{2+3} ending rather close to tip of R_1 ; fork of *Cu* immediately before *m*. Halteres yellowish.

Length of body 4 mm.; wing 2.5 mm.

FIJI: Lautoka, 11. v. 1921 (W. Greenwood), 3 ♂.

BIBLIOGRAPHICAL NOTICES.

British Waders. By E. C. ARNOLD. Demy 8vo. Pp. 102, with 51 Coloured Plates. London: Cambridge University Press, 1924. 70s. net.

THE Waders form a group which is a favourite one with most field-naturalists, both on account of the charm of the birds themselves and on account of their surroundings. Mr. Arnold is one of those who have been attracted by these charms, and he has now succeeded in writing and illustrating a most attractive book about them.

The plates, all painted by Mr. Arnold himself, are excellent pictures, but are, perhaps, more impressionist than they are attempts to give drawings of the birds which are absolutely correct in all details. The attitudes of the birds are natural and very much alive, but in certain of the plates the colours seem to be too pale, and this is especially the case in the grey birds. In part, this is due to the actual colour being rather paler than it is in life, as in the Grey Phalarope. In other plates it is perhaps more due to the large extent of the white breast and abdomen, which the artist depicts in so many of his birds, as in the Little Stint. The red also, when this colour forms part of the bird's plumage, is, we think, too vivid and too pink. The pictures of the Knot and the Curlew-Sandpiper are examples of this. On the other hand, it is perhaps true, as the author claims, that some artists make their birds look too dull and their reds too brown.

As regards the text, the author gives no full descriptions of the birds, but he relies on their principal characteristics (whether these be of colour, flight, or voice) as a method of distinguishing one from another. On the whole, he has been very successful in seizing

upon those particular points which will suffice to enable field-naturalists and observers to identify the Waders they may come across, but in others, as he himself admits, identification of the living bird in the flesh is too difficult for him to be able to give any useful hints.

Many of his notes on the habits of the birds are full of interest, and naturalists will, we are sure, be delighted, though perhaps very surprised, to find that the Grey Phalarope has bred in the south of England and that the Redshank is in the habit of carrying its young in its feet. To those who, like so many of us, have spent many a long day in the marshes watching this most fascinating bird (the Redshank), the latter of these two strange facts may appear the stranger.

In some respects the author has been unfortunate in his failure to observe some of our very common Waders. Thus he says he *believes* the Oystor-catchers still breed in Norfolk. As a matter of fact, everyone *knows* that some thirty or forty pairs at least breed every year in this county.

As regards Mr. Arnold's nomenclature and classification it is not perhaps fair to comment, as he nowhere claims that his book is anything but a popular one. At the same time, we think it is a pity that, having referred to Mr. Witherby's excellent hand-book with such approval, he did not adhere to Mr. Witherby's scientific names. With Mr. Witherby he apparently disagrees in many important details. For instance, he still retains the Stints and Dunlins under the generic name of *Erolia*, dividing them from the genus *Calidris*, of which the Knot is the type. Again, *Tringa brevipes* he promotes to the rank of a species, though most naturalists accept it as merely a geographical race of *T. cana*. So also he names the Stilt, *Hæmatopus hæmatopus*. This bird should, of course, be given the trinomial, as there are other geographical races bearing a different name.

In spite, however, of these, in a book of this nature, trivial inconsistencies, Mr. Arnold has written a book which one reads with pleasure and which will be a very real help to beginners in the field.

The Animals of New Zealand. By Capt. F. W. HUTTON, F.R.S., and JAMES DRUMMOND, F.L.S. Auckland: Whitcombe & Tombs, Ltd. Pp. 434, numerous Illustrations. 15s.

THIS little volume claims to contain the whole of the known mammals, birds, and reptiles to be found in New Zealand, and within the small compass of about 400 pages a mass of information has been compiled such as is to be found in very few other volumes of a similar size. The descriptions given are very brief, but are distinctly to the point, and should suffice for all requirements of identification.

The black-and-white illustrations are numerous and good, whilst the field-notes are extremely full and interesting. It is often true of a book that the most important part is to be found in the

introduction. We cannot, perhaps, say this in the present instance, but we would like to draw the attention of every reader of this excellent little book to the remarks made by the authors on the introduction of extralimital species, whether fauna or flora, into any country, and we think that, had it never occurred to the authors to publish a book on the Animals of New Zealand, we should have lost comments of great value on this subject which they have written here.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

June 4th, 1924.—Dr. J. W. Evans, C.B.E., F.R.S.,
President, in the Chair.

The following communication was read:—

‘On a New Catopterid Fish from the Keuper of Nottingham’.
By Prof. Henry Hurd Swinnerton, A.R.C.S., D.Sc., F.G.S.

Certain excavations made at Woodthorpe, near Nottingham, passed through the lowest beds of the Keuper Waterstones, and brought to light numerous well-preserved remains of fossil fishes belonging chiefly to the genus *Semionotus*. Among these were found specimens of a small fish which proved to be a new species of the genus *Dictyopyge*. These were sufficiently well preserved to throw valuable light upon the osteology of this comparatively little-known genus.

This small fish is only 4·5 centimetres long, and slightly more than 1 cm. deep. Its head occupies a fifth of the length of the body, and in the sum total of its osteological characters resembles the Eugnathidæ rather than the Palæoniscidæ. The pectoral girdle, however, has an infraclavicle, a feature which is diagnostic of the Catopteridæ. The trunk and tail are clad with enamel-covered scales. Both paired and unpaired fins are of moderate proportions, and have their anterior margins strengthened by short spiny rays and a few fin fulcra. While the tail may be described as hemiheterocercal, it differs from typical examples of this type, in the fact that the upturned lobe of the caudal pedicle is produced towards the tip of the fin by means of an attenuated scale-clad extension. This feature does not appear to have been noticed in other Mesozoic fishes, and may be regarded as indicative of a more primitive condition than that usually seen in them.

The detailed study of this new species confirms the usually accepted opinion that the Catopteridæ, although classed with the Chondrostei, approach the Protospondyli. It shows, however, that this approach is closer than is generally supposed, and that some members of the family Catopteridæ, as at present constituted, may be described as primitive Eugnathidæ.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.
[NINTH SERIES.]

No. 84. DECEMBER 1924.

LXV.—*Descriptions and Records of Bees*.—CIII.
By T. D. A. COCKERELL, University of Colorado.

Hylæus nigrolineatus, sp. n.

♂ (type).—Length about 4·5 mm., anterior wing 3·7.

Black, rather slender, the thorax with fine pale hair; orbits strongly converging below; clypeus and cuneiform lateral face-marks very bright lemon-yellow, but conspicuous black sutural lines at sides of clypeus; lateral marks ending obliquely above, the highest point on orbital margin; no supraclypeal mark (face-marks somewhat after style of *H. nevadensis*, Ckll., but upper inner side of lateral marks much shorter); labrum and mandibles black; scape normal, black; flagellum rather narrowly ferruginous beneath, the colour not bright; mesothorax and scutellum dullish, closely punctured; area of metathorax finely and irregularly reticulate, with a transverse ridge across the middle, and below this three vertical plicæ, but the apical area otherwise with very delicate cross-plicæ; tubercles and tegulæ entirely dark. Wings dusky, first recurrent nervure meeting intercubitus or going slightly beyond. Anterior tibiæ and tarsi pale red; mid-tibiæ at extreme base and hind ones at base broadly very pale yellow; mid and hind basitarsi creamy-white, their tips and the small joints infuscated. Abdomen polished, constricted at base of second segment; first

segment with very fine and sparse piliferous punctures, and traces of transverse striæ.

♀.—No light markings on head or thorax; legs black, anterior tibiæ with a dull red basal area in front, extreme base of hind tibiæ very faintly pallid; wings strongly reddish; area of metathorax with fine rugose sculpture; but no distinct longitudinal plicæ; first abdominal segment with very sparse excessively fine punctures, and no transverse striæ in apical region.

Okcanskaja, Siberia (type-locality), August 5, 2 ♂, 1 ♀ (*Cockerell*); Kongaus, Aug., 1 ♀ (*Cockerell*).

Related to the American *H. polifolii*, Ckll., *nevadensis*, Ckll., and *hesperiphila*, Ckll., but distinguished at once by the form of the lateral face-marks. *H. atrocillosus*, Morawitz, from Turkestan, a species unfortunately omitted in Meade-Waldo's enumeration, has the face all black and the tubercles black in the female, but it is considerably larger, with spotted tegule, &c.

Another female *H. nigrolineatus* from Kongaus (variety *a*) has very minute linear yellow lateral face-marks.

Hylæus atromicans, sp. n.

♀.—Length about 5.5 mm., anterior wing 4.8.

Black, robust, with very scanty hair, the abdomen bare and polished; face very broad, entirely black, shining with a satiny lustre; antennæ with a hardly perceptible reddish tint beneath; mesothorax and scutellum somewhat shining, closely but very distinctly punctured; area of metathorax with delicate but very distinct basal longitudinal plicæ (whereby it is readily distinguished from *H. nigrolineatus*); tegulæ all black, but tubercles narrowly tipped with lemon-yellow. Wings dilute fuliginous, second cubital cell long, first recurrent nervure going slightly beyond intercubitus. Legs black, the hind tibiæ with more than basal third bright yellow; first abdominal segment with very widely scattered and fine excessively minute punctures, and fine cross-striæ in apical region. The facial foveæ below are very widely separated from orbits, with a few scattered punctures between. (In *H. nigrolineatus* it is not so widely separated, and in the interval is a single row of punctures.)

Okeanskaja, Siberia, August 5, 1 ♀ (*Cockerell*).

This runs nearest to *H. rinki* in Alfken's tables, but is a smaller insect. In the American fauna it recalls *H. gaigei*, Ckll., but has a broader face, different metathorax, and bright yellow bases of hind tibiæ.

Hylæus brevicuneatus, sp. n.

♀.—Length about 5 mm., anterior wing 4·3.

Black, robust, with very scanty hair, no traces of bands on abdomen; head entirely black except the cuneiform bright lemon-yellow lateral face-marks, which are comparatively short, shorter than the interval between them, flattened on inner side, and obliquely truncate above, not reaching as far as antennæ; flagellum very obscurely reddish beneath; mesothorax dull, very finely and closely punctured, scutellum shining; area of metathorax cancellate above the transverse keel, below it microscopically reticulate; tubercles and tegulæ entirely dark. Wings reddish hyaline, stigma dusky red; second cubital cell rather long, first recurrent nervure meeting intercubitus, basal nervure meeting nervulus. Legs black, the hind tibiæ briefly cream-coloured at base; first abdominal segment highly polished, with fine sparse piliferous punctures, and weak cross-lineolation in apical region. The facial foveæ are close to eye, with one row of punctures between.

Kongaus, Siberia, Aug., 1 ♀ (*Cockerell*).

The face-markings suggest those of *H. modestus*, but are different in detail. *H. agricollis*, Mar., from Turkestan, is another species with black tubercles, and lateral face-marks present.

Hylæus lavrushini, sp. n.

♀.—Length about 5·3 mm., anterior wing 4·3.

Black, robust, with very scanty hair; head black, with light lemon-yellow cuneiform lateral face-marks, longer than the distance between them, very obliquely truncate above, ending in a point on orbital margin, the upper inner side very much shorter than the lower, and sometimes notched; facial foveæ not widely divergent from eye, one row of punctures between, and a smooth band between punctures and fovea; flagellum obscurely reddish beneath; mesothorax and scutellum somewhat shining, well punctured; tegulæ dark, but tubercles edged with yellow; area of metathorax with strong parallel plicæ above the keel, but below with microscopic lineolation. Wings reddish hyaline, second cubital cell rather short, first recurrent nervure meeting intercubitus, basal nervure meeting nervulus. Legs black, hind tibiæ briefly cream-colour at base; abdomen polished, quite without hair-bands, first segment excessively finely and sparsely punctured, impunctate in middle.

Kongaus, Siberia, Aug., 2 ♀ (*Cockerell*).

Named after Mr. A. J. Lavrushin, guide and interpreter to the expedition.

The *Hyla* of the Maritime Province of Siberia may be separated thus:—

- | | | |
|--|-----|--|
| Clypeus yellow; males | 1. | |
| Clypeus black (or with a yellow dot); females .. | 8. | |
| 1. Scape greatly broadened, one side yellow .. | 2. | |
| Scape ordinary, or at least not as above | 3. | |
| 2. Lateral face-marks pointed above, not curving away from orbit | | <i>polevoia</i> . |
| Lateral face-marks obliquely truncate above, curving away from orbit | | <i>cardioscapus</i> . |
| 3. Clypeal yellow narrowed or hardly broadened below; upper part of clypeus usually with a median sulcus. | | <i>nigrocuneatus</i> . |
| Clypeal yellow conspicuously broadened below, the lower corners of clypeus not black | 4. | |
| 4. Larger species, with lateral face-marks ending in a sharp point on orbit. | 5. | |
| Smaller species, lateral marks not so ending.. | 6. | |
| 5. Face sulphur-yellow, supraclypeal mark present | | <i>wilmattæ</i> . |
| Face orange, supraclypeal mark absent | | <i>transversalis</i> . |
| 6. Lateral face-marks broader above than top of clypeus, supraclypeal mark well developed. | | <i>concinus</i> . |
| Lateral face-marks not broader above than top of clypeus | 7. | |
| 7. Supraclypeal mark present; very small species | | <i>lepidulus</i> . |
| Supraclypeal mark absent | | <i>nigrolineatus</i> . |
| 8. Face entirely black | 9. | |
| Lateral face-marks present. | 10. | |
| 9. Tubercles broadly yellow, flagellum bright ferruginous beneath | | <i>sinicola</i> . |
| Tubercles with an apical yellow spot, flagellum dark, base of metathorax with distinct plicæ. | | <i>atromicans</i> . |
| Tubercles wholly black, flagellum obscurely reddish beneath, no distinct plicæ on base of metathorax | | <i>nigrolineatus</i> . |
| 10. Lateral face-marks very minute, almost obsolete; tubercles entirely black | | <i>nigrolineatus</i> , var. <i>α</i> . |
| Lateral face-marks evident. | 11. | |
| 11. Tubercles entirely black, lateral face-marks cuneiform | | <i>bravicuneatus</i> . |
| Tubercles at least edged with yellow | 12. | |
| 12. Lateral face-marks reddish white; tegulae with a conspicuous white spot | | <i>pallascens</i> . |
| Lateral face-marks yellow | 13. | |
| 13. Lateral face-marks evidently cuneiform, broadened above; tegulae with no light spot | 14. | |
| Lateral face-marks linear or bow-shaped. | 16. | |
| 14. Lower margin of clypeus red; larger species. | | <i>wilmattæ</i> . |

- | | |
|--|------------------------|
| Lower margin of clypeus black; smaller species | 15. |
| 15. Clypeus with a yellow dot; lateral marks orange..... | <i>monostictus</i> . |
| Clypeus with no yellow dot; lateral marks clear yellow | <i>lavrushini</i> . |
| 16. Lateral face-marks shorter, bow-shaped or triangular | <i>nigrocuneatus</i> . |
| Lateral face-marks long, linear | 17. |
| 17. Broader; tegulae without spot, apical part of metathoracic area sculptured | <i>cardioscopus</i> . |
| Narrower; tegulae more or less spotted, apical part of metathoracic area not distinctly sculptured | <i>polevoia</i> . |

Halictus (Seladonia) tumulorum (L.).

Females were collected in Siberia on the Kudia River, July; at Preobrageniya Bay, July 12, and at Kongaus, August. These differ a little from European *H. tumulorum* in that the area of metathorax is finely sculptured all over, but one specimen (Kongaus) does show a broad shining margin, so it is of doubtful advantage to separate the Siberian form. Possibly the male will show more difference.

Halictus (Seladonia) eruditus, sp. n.

♀.—Length about 6.5 mm., anterior wing 5.

Face, cheeks, and metathorax blue-green; vertex, mesothorax, and scutellum olive-green; abdomen olive-green above, piceous below; legs black, with the knees yellowish, tibiae at apex and small joints of tarsi pale reddish, the scopa on hind tibiae pale fulvous; tubercles yellow; hair of head and thorax above lively ferruginous; abdominal bands (interrupted on first two segments) very pale fulvous; head very large, quadrate, with enormously developed occipital region; eyes parallel; mandibles bidentate, strongly curved; clypeus very low and broad, polished, with few punctures, depressed in middle, nearly apical half black; front dull, with excessively dense minute punctures; flagellum red beneath; mesothorax and scutellum shining, finely punctured; area of metathorax poorly defined, covered, except marginally, with excessively fine dense striae; posterior truncation with a deep pit; tegulae clear rufo-fulvous. Wings greyish hyaline, with an orange suffusion, stigma and nervures pale reddish testaceous, second cubital cell very narrow. Hind spur with two or three large nodules. Abdomen shining, with very fine punctures.

Okcanskaja, Siberia, Aug. 18, 2 ♀ (*Cockerell*).

Allied to the Japanese *H. nikkoensis*, Ckll., but larger, with differently coloured pubescence.

Halictus (Chloralictus) mayacensis, sp. n.

♀.—So similar to the European *H. smeathmanellus* (Kirby) that it might be regarded as a race or subspecies. It differs by the somewhat narrower face, with less arcuate orbits; more closely punctured, less shining, mesothorax; much darker (dark brown to nearly black) tegulae; more dusky wings, with duskier stigma; area of metathorax more regularly and evidently striate; abdomen not so green.

Low Lighthouse, coast of Siberia between Valentino Bay and Olga, Jan. 13, 19 ♀ (*Cockerell*).

The *H. smeathmanellus* compared are from Bozen, Tirol (*Friese*), Richmond, Surrey (*Cockerell*), and St. Helens, I. of Wight (*W. P. Cockerell*). Both species have the same long head and long-pectinate hind spurs.

Acanthalictus dybowskii (Rad.).

I had overlooked a male of this species, taken at Kongaus, Aug. 9. It is about 10.5 mm. long, and easily recognised by the peculiar clypeus, which is snout-like, strongly arched apically, and entirely black. Mandibles very broad at base, highly polished; antennae long, joints 3 to 7 clear ferruginous beneath, the flagellum with fine pale tomentum; anterior tibiae chestnut-red in front, tarsi dark brown; wings very brown, second cubital cell much narrowed above; apical plate of abdomen broad, with a large highly polished depression; beneath this, at apex of venter, is a broad dark red projecting plate. The abdomen has no distinct hair-bands.

Halictus calceatus (Scopoli).

One ♀, Okcanskaja, Siberia, Aug. 5 (*Cockerell*).

A well-known European species.

Halictus morbillosus, Kriechbaumer.

This well-marked species is now found to extend from Europe to the coast of Siberia, but in its wide range it is represented by distinct races, as follows:—

(a) *egyptiellus*, Strand, based on a male from Egypt, browner than the type.

(b) *glasunovi*, n. race; male with reddened labrum and

mandibles, and other characters, found by Glasunow at Varsaminor, Turkestan, and recorded by Morawitz, Horæ Soc. Ent. Ross., Nov. 1893, p. 76.

- (c) *orientis*, n. race; female with head narrower, angles of prothorax rather more prominent, wings perceptibly reddish, apical depression of first abdominal segment less distinctly punctured, hair on inner side of hind tibiæ and tarsi pale yellow, on outer side of tibiæ posteriorly dark fuscous. Kongaus, Siberia (type-locality), 4 ♀, Aug. (Cockerell); Okeanskaja, Aug. 5, 1 ♀ (Cockerell).

The *orientis* form, from a very moist region, is more melanic than the type; the other two named forms diverge in an opposite direction, coming from dry or desert regions. The shining mesothorax of *H. morbillosus orientis* recalls *H. equestris*, Mor., but the dark tegulæ and other characters separate it at once.

Halictus tetrazonius, Klug.

Okeanskaja, Siberia, Aug. 18, 1 ♀ (Cockerell).

Compared with European specimens, it is a little larger, and the mesothorax is more densely punctured and less shining; thus it departs from the type in the opposite direction to the Chinese race *tsingtauensis*, Straud.

Halictus (Curtisapis) alinensis, sp. n.

♀ (type).—Length about 9 mm., anterior wing 6.2.

Black, head and thorax with erect dull white hair, faintly tinged with reddish on thorax above; head broad oval, the face rather narrow; clypeus produced, finely roughened but shining; front dull, vertex shining; flagellum dark, with a hardly perceptible reddish tinge beneath; angles of prothorax distinct, but not much produced; mesothorax and scutellum finely and closely punctured, but shining between the punctures; area of metathorax broad, with over 20 distinct, more or less wavy, longitudinal rugæ; posterior truncation sharply defined, but with no special structure at upper corners; tegulæ black with narrow pallid margin, varying to dark reddish. Wings hyaline, faintly brownish; stigma and nervures reddish testaceous; second cubital cell narrow, third broad but not much produced apically. Legs black, with much pale hair, ferruginous or (Okeanskaja specimen) practically white on inner side of tarsi; hind

tibiæ with a variable amount of dark hair posteriorly; hind spur coarsely serrate, the teeth broad and obtuse. Abdomen moderately shining, finely punctured, the entire first segment, including the broad depressed apical part, closely beset with very fine punctures; basal part of first segment with pale tomentum, but it is not dense; bases of segments 2 to 4 with entire bands of white tomentum.

♂.—Less robust, but stout for a male; face broad, densely covered with white hair; clypeus with a large creamy-white apical patch; antennæ moderate, coloured as in female; tegulæ brownish; tibiæ and basitarsi entirely black; abdomen shining, the banding less distinct.

Amagu Village (type-locality), Siberia, July, 2 ♀ at flowers of *Iris* (Cockerell); Kudia River, July, 4 ♀ (*W. P.* and *T. D. A. Cockerell*); Olga, July 13, 2 ♀ (*Cockerell*); Okeanskaja, Aug., 1 ♀ (*Cockerell*); Kongaus, Aug. 9, 1 ♂ (*Cockerell*). These localities are near the foot of the Sichota Alin Range.

Closely allied to the European *H. leucozonius*, Schrenk, but the female is readily distinguished by the more closely and finely punctured mesothorax, and paler venation, with smaller second cubital cell. The male is easily separated by the black basitarsi. Among the Japanese species, there is some resemblance to *H. basicirus*, Ckll.

Halictus (Curtisapis) tacitus, sp. n.

♀.—Length about 10 mm., anterior wing 7.5.

Black, including mandibles, antennæ, and legs; head oblong; clypeus rugoso-punctate; front dull, vertex more shining; head and thorax with dull pale ochraceous hair, becoming a sort of dilute chocolate on scutellum; mesothorax and scutellum dull, and excessively densely punctured; area of metathorax large, poorly defined, appearing rugose under a lens, but with a delicate sculpture of fine lines forming an irregular network; posterior truncation with a wrinkled surface and sharp margins, but no special projections at upper corners; tegulæ black with narrow pale margin. Wings dilute fuliginous, stigma and nervures dull ferruginous; second cubital cell broad, third not nearly twice as broad as second. Legs with pale ochraceous hair, black on outer side of hind tibiæ, orange on inner side of tarsi; hind spur very coarsely serrate, with broad obtuse lobes or teeth. First abdominal segment dull, with close excessively minute punctures all over, and no conspicuous hair on basal part (except in lateral view, the thin hair being erect); remaining segments also dull and

minutely punctured, with entire greyish-white bands at bases of segments 2 to 4; caudal rima dark purplish brown; hair on venter largely reddish.

Kongans, Siberia, Aug. 9 (*Cockerell*).

Another member of the *H. leucozonius* group, readily known by the dark wings and peculiar sculpture.

Halictus chaldæorum, Morice.

Blüthgen has recently claimed that *H. chaldæorum* from Mesopotamia and *H. micado*, Strand, and *H. statialis*, Ckll., from Formosa, are one species. This seemed so improbable that I sought further advice, and Dr. J. Waterston was good enough to compare the specimens in the British Museum. He is definitely of the opinion that *chaldæorum* is distinct: "the mesothoracic punctuation is sparser and the interspaces are smooth. In the other two the punctuation is much denser and the interspaces are reticulate, so that the thoracic notum appears a little duller." It may be added that Dr. Waterston fails to find any difference between *H. statialis* and *H. micado* as represented in the Museum. Strand describes *H. micado* as 8 mm. long, with the flagellum at end scarcely brownish; *H. statialis* is about 6 mm. long (herein like *chaldæorum*), and the flagellum is ferruginous at end. The question of their identity must be considered unsettled, but it is significant that Blüthgen had both the types before him.

LXVI.—*Papers on Oriental Carabidæ*.—XIV.

By H. E. ANDREWES.

IN this paper I describe a new genus and species belonging to the Ozænini. In addition, a series of notes will be found, chiefly on synonymy. Most of these are the result of a second visit paid last year to Mr. René Oberthür at Rennes, when he very kindly allowed me to make a further examination of the Chaudoir, Bates, and other collections.

ANENTMETUS, gen. nov.

Head large, narrowly bordered at sides, eyes widely separated from buccal fissure, genæ slight, glabrous, not embracing eyes behind, outer side of buccal fissure dilated into a plate, visible from above; clypeus narrowed in front,

strongly emarginate, without setæ, suture well marked, labrum slightly emarginate, plurisetose; mandibles short and wide, slightly hooked and sharp at apex, several setæ placed along the lower margin of sciole; ligula narrow, 4-setose, paraglossæ wide, leathery, extending a little beyond ligula but not enveloping it, the border microscopically setulose; mentum with a deep sinus and a sharp bordered tooth, epilobes wide, extending to apex of both lobes and tooth; maxillæ curved, sharp, slightly hooked at apex, densely ciliate within almost to apex, outer lobe jointed; palpi short and thick, apical joint setulose, truncate at apex, a little dilated in maxillaries and fully twice as long as 3, securiform in labials and a little longer than 2, which is bisetose on inner margin; antennæ short, thick, flattened, pubescent, but only fully so from joint 5, joint 11 about half as long again as 10. *Prothorax* cordate, sides explanate, without setæ, front angles rounded, not produced. *Elytra* 9-striate, without scutellary striae, intervals without punctures, border behind strongly reflexed for a short distance at about apical fourth and pressed tightly against the elytra, without notch. *Sternum*: prosternal process glabrous, not bordered, mesocoxæ separated, metacoxæ almost but not quite touching. *Venter* sparsely setulose at sides, penultimate segment with a transverse row of setæ, last one (♂) with a number of setæ disposed in a semicircle round apex, last tergite very convex, overhanging and extending rather beyond last ventral segment. *Legs* short but strong, profemora sulcate beneath, tibiæ carinate, pubescent, tarsal joints short, pubescent on upper surface, pro- and mesotarsi (♂) with joints 1 and 2 slightly dilated and clothed beneath with scales, claws simple. Body pedunculate, upper surface very finely punctulate, but not pubescent.

The type of the genus is *A. pluto*, described below, but I feel no doubt that Fairmaire's *Pseudozæna spissicornis* (Ann. Soc. Ent. Fr. 1888, p. 335) also belongs to it. The characters given in the description, Mr. Lesne's notes (Miss. Pavie Hist. Nat. 1904, 62. t. viii. fig. 13), and the notes which I made myself a year or two ago, when working at the Paris Museum, all confirm this. Mr. Lesne put the species provisionally under *Pachyteles*, though remarking that it differed in some of its generic characters.

Anentmetus *pluto*, sp. n.

Length 10.0 mm.; width 3.0 mm.

Piceous-black; underside, palpi, joint 1 of antennæ, and legs brown-red.

Head slightly convex, frontal impressions short and shallow, sides of front with some fine longitudinal striation, labrum 7-setose, eyes large and prominent, antennæ reaching base of prothorax, surface punctate, clypeus very finely, neck more coarsely, vertex almost smooth. *Prothorax* slightly convex, a little wider than head and two-thirds wider than long, base truncate, with its sides rather oblique, a little narrower than apex, which is faintly emarginate, widest at about apical fourth, sides a little reflexed, gently rounded and sinuate rather before base, front angles rounded, hind ones sharply rectangular and projecting laterally; median line fine, transverse impressions both deep, surface finely punctate, with some transverse striation across base. *Elytra* moderately convex, parallel, a little wider than prothorax, twice as long as wide, border rounded at shoulder, glabrous, striæ shallow, finely and indistinctly punctate, intervals only slightly convex, a little more so near base, punctures of marginal series hardly interrupted, but not very close together. The whole of the upper surface is covered by a very fine, nearly isodiametric microsculpture.

KUMAON: Haldwani Division (*H. G. Champion*), 1 ex., ♂. This type is in the British Museum.

Pseudozæna (Picus) obscura, Chaud. Rév. du groupe des Ozénides, Ann. Soc. Ent. Belg. xi. 1868, p. 46 = *P. orientalis*, Klug, Jahrb. 1834, 81. t. i. fig. 8.

The type of Chaudoir's species seemed to me to differ in individual characters only from the well-known *P. orientalis*, and, although I have not seen Klug's type, I see no reason to doubt their identity. On the other hand, *P. opaca*, Chaud., described on the same page, of which I also examined the type, appeared quite distinct. Chaudoir gave as locality "Inde transgangétique," but the two examples in his collection are labelled "Ceram (*Wallace*)" and "Ternate." The only other specimens I have seen came from Formosa.

Nebria lividipes, Fairm. Ann. Soc. Ent. Fr. 1886, p. 306 = *N. chinensis*, Bates, Ent. Month. Mag. ix. 1872, p. 52.

In Fairmaire's specimen the tibiæ and tarsi are very pale.

Coptolobus taprobanæ, Chaud. Mon. des Scaritides (i.), Ann. Soc. Ent. Belg. 1879, p. 161 = *C. anodon*, Chaud. (p. 160).

The type of the latter is larger and wider than that of the

former, and the prothorax is rather less contracted in front. I have compared the types both with each other and with other specimens, and conclude that all belong to one species.

Bembidium sp., Rec. Ind. Mus. xviii. (ii.) 1919, p. 99.

I was unable at the time to identify this insect from Nasratabad, Seistan. I now find it to be *B. quadraticolle*, Motch. Ins. Sib. 1844, p. 270.

Brachyonychus [*Epicosmus*] *humeralus*, Chaud. Rev. et Mag. Zool. 1869, p. 69 = *B. sublævis*, Chaud. (p. 67).

Craspedophorus [*Epicosmus*] *hilaris* and *rufipalpis* [Laf. in litt. Ann. Soc. Ent. Fr. 1851, p. 221], Chaud. Mon. sur les Panagoides, Ann. Soc. Ent. Belg. 1878, p. 110.

Chaudoir treated these as one species, but to me they appear quite distinct. I have in my collection an example of *hilaris*, which I compared with the type, and there are others in the British Museum. In this species the front spot extends inwards to stria 2, whereas in *rufipalpis*, a much smaller insect, it only reaches stria 3. Chaudoir thought that *hilaris* might be the same thing as *geniculatus*, Wied., which is not the case; *rufipalpis*, on the other hand, must be very near to, if not identical with, Wiedemann's species.

Chlænius extremus, Chaud. Mon. des Chlæniens, Ann. Mus. Civ. Gen. viii. 1876, p. 112 = *C. postscriptus*, Bates, Trans. Ent. Soc. Lond. 1873, p. 326.

Chlænius pratensis, Chaud. Mon. des Chlæniens, p. 210 = *C. prostenus*, Bates, Trans. Ent. Soc. Lond. 1873, p. 325.

Chlænius semicyaneus, Andr. (not Solsky), Rec. Ind. Mus. xviii. (ii.) 1919, p. 100 = *C. flavipes*, Mén. Cat. rais. 1832, p. 114.

Chlænius yunnanus, Andr. Ent. Month. Mag. 1920, pp. 236 & 238 = *C. convexus*, Fairm. Ann. Soc. Ent. Fr. 1886, p. 310.

Oodes levissimus, Chaud. Mon. des Oodides (i.), Ann. Soc. Ent. Fr. 1882, p. 361.

I regard this species, although it is quite black, as a *Simous*; at the same time I do not consider this genus very

clearly differentiated from *Oodes*. The presence of a minute seta on the hind angles of the prothorax is not a distinguishing character, for it occurs also in some species of *Oodes* (e. g., *O. parallelus*, Laf.), but the tooth of the mentum, though not distinctly emarginate, is hollowed out beneath, and bent rather strongly upwards at apex.

Melanodes pernitidus, Chaud. Mon. des Oodides (ii.), Ann. Soc. Ent. Fr. 1882, p. 550 = *M. subelongatus*, Chaud. (also p. 550) = *Dicæolindus* (*Arsenowenus*) *harpaloides*, Bates, Ann. Mus. Civ. Gen. 1892, p. 365.

Chaudoir's two species differ only a little in form, and appear to me to be the same thing, redescribed by Bates, as mentioned above.

In the African species of *Melanodes* the ♂ protarsi have three dilated joints, closely spongiöse beneath; the upper surface of the body is minutely punctulate, and there is, in addition, a fine but distinct microsculpture formed by a reticulation with isodiametric meshes. In *Dicæolindus* the ♂ protarsi are not dilated; their surface beneath is smooth along the middle, with a row of narrow whitish scales along the margin at each side. The upper surface is similarly punctulate, but the microsculpture consists in extremely closely placed transverse lines, just visible under the microscope ($\times 75$), on prothorax and elytra, though the head is minutely reticulate. In general appearance the African and Asiatic species are extraordinarily alike, but, with such widely different ♂ tarsal clothing, belong apparently to different genera, if not to different tribes. I do not see my way at present to reconcile these contradictory features.

In 1919 (Trans. Ent. Soc. Lond. p. 149) I stated that the Indian and Burmese *D. harpaloides*, Bates, was identical with the Javan *D. felspaticus*, MacL. The two species are remarkably alike, but the examination of further material leads me to think they are distinct. *D. harpaloides* is a little longer, the frontal foveæ less deeply impressed, the eyes rather flatter, the basal sulci of the prothorax longer and more distinctly linear, the elytra somewhat longer, the metepisterna more or less punctate. The mandibles are normal, whereas in *D. felspaticus* (as also in the Ceylonese *D. impunctatus*, Bates) the right mandible ♂ has the upper margin of the scrobe raised into a projecting knob. The Indian species should be known as *D. pernitidus*, Chaud.

Eccoptogenius (Rhembus) distinguendus, Laf. Ann. Soc. Ent. Fr. 1851, p. 278; Andr. Trans. Ent. Soc. Lond. 1921, p. 147.

In this genus the first joint of the antennæ is clavate, but the presence of a single character like this seems hardly sufficient to justify exclusion from *Diplochila*, to which genus I think the species should be referred.

Chydæus (Acrogeniodon) semenovi, Tchitch. Hor. Soc. Ent. Ross. xxxii. 1893, p. 660; Andr. Ann. & Mag. Nat. Hist. (9) iii. 1919, p. 473 = *C. obscurus*, Chaud. Bull. Mosc. 1854, ii. p. 344.

Tchitcherine's type is not likely to be available at present, but, after re-examining Chaudoir's and comparing with it specimens from Sikkim, of which I have now seen a good many, I feel justified in treating these two species as identical.

Dioryche (Platymetopus) amœna, Dej. Spec. Gen. iv. 1829, p. 73; Andr. Trans. Ent. Soc. Lond. 1921, p. 147 = *D. torta*, MacL. Ann. jav. 1825, p. 21; Andr. Trans. Ent. Soc. Lond. 1919, p. 154.

After examining additional specimens from Java as well as from numerous other localities in the East, I think the slight differences previously observed are individual only, and propose to treat the two species as one.

Stenolophus fugax, Lesne (not Dej.), Miss. Pav. Hist. Nat. 1904, p. 76 = *Acupalpus ovatulus*, Bates, Ann. Soc. Ent. Fr. 1889, p. 273; Andr. Trans. Ent. Soc. Lond. 1921, p. 177.

I have compared this specimen, which Mr. Lesne very kindly sent me, with Bates's type. I have not seen Dejean's type, which came from Senegal, a locality sufficiently remote from Indo-China; apart from this, the fourth tarsal joint in *ovatulus* is barely emarginate, whereas in *Stenolophus* it is bilobed.

Lesticus waterhousei, Chaud. Rev. et Mag. Zool. 1862, p. 489; id. Rév. des Trigonotomides, Ann. Soc. Ent. Belg. xi. 1868, p. 155.

Chaudoir did not know the locality of his specimen, though he thought it came from North India. I have now an

example coming from Chandkira in Sylhet (*J. L. Sherwill*), which I was able when at Rennes to compare with the type.

Trigonotoma crenata, Chaud. R  v. des Trigonotomides, Ann. Soc. Ent. Belg. xi. 1868, p. 159 = *T. dohrni*, Chaud. Bull. Mosc. 1852, i. p. 69 ; id. R  v. p. 159.

The differences indicated by Chaudoir in his "R  vision" are of the slightest description.

Morio cucujoides, Chaud. (not Walk.), Ess. monogr. sur les Morionides, Bull. Mosc. 1880, ii. p. 342 = *M. subconvexus*, Chaud. Mon. p. 340 = *M. submarginatus*, Chaud. Mon. p. 342 = *M. orientalis*, Dej. Spec. Gen. i. 1825, p. 432 ; Chaud. Mon. p. 338.

I examined all these types, and could find no distinguishing characters. *M. orientalis* is widely spread in the East, and varies considerably in size, form, and sculpture.

Morio intermedius, Chaud. Mon. p. 344 = *M. luzonicus*, Chaud. Bull. Mosc. 1852, i. p. 81 ; id. Mon. p. 344.

The difference between these species lies in their unequal size. The other characters relied on by the author to distinguish them are very slight, and, after a comparison of types, appeared to me inadequate. I have seen many specimens of varying size and from many localities.

Nanochl  nius f  x, Bates, Ann. Mus. Civ. Gen. 1892, p. 322
= *  psera ferruginia*, Chaud. Bull. Mosc. 1874, i. p. 30.

Colpodes c  lopterus, Chaud. R  v. des Colpodes, Ann. Soc. Ent. Fr. 1878, p. 368 = *C. olivius*, Bates, Trans. Ent. Soc. Lond. 1873, p. 330.

Hexagonia andamanensis, Pllde. Insecta, iv. 1914, p. 165 =
H. terminata, Kirby, Trans. Linn. Soc. xiv. 1825, p. 564.

Dinopelmus plantigradum, Bates, Proc. Zool. Soc. 1889, p. 385 ;
Andr. Trans. Ent. Soc. Lond. 1919, p. 197.

Bates placed his genus among the Otenodactylini, but there is a mobile hook at the apex of the maxill  , and it should therefore be referred to the Hexagoniini.

ARAME, Andr. Ann. & Mag. Nat. Hist. (9) iii. 1919, p. 477.

This genus, which I proposed for a number of species formerly referred to *Cusnonia*, I now think generically indistinguishable from *Oducantha*. In none of the Eastern species known to me is there so distinct a border to the prothorax as in the Palæarctic *melanura*, L., but there are sometimes evident traces of it, as in *ægrotæ*, Bates, *tetraspilota*, Schm. Goeb., towards apex, and *obesa*, Andr., towards base. The shape and striation of the elytra are variable, and in *chaudoiri*, Boh., *pilifera*, Nietn., etc., not only have the striæ almost disappeared, but there is a deep transverse impression across the base. For these it may be desirable at some future time to form another genus, but this must wait until some general revision of the group can be undertaken.

Selina ritsemæ, Oberth. Notes Leyd. Mus. v. 1883, p. 223 = *S. westermanni*, Motch. Etud. Entom. 1857, 110. t. fig. 6.

Drypta crassiuscula, Bates (not Chaud.), Ann. Mus. Civ. Gen. 1892, p. 383; Andr. Trans. Ent. Soc. Lond. 1923, p. 6.

This form must be treated as a distinct species, and I therefore propose for it the name of *D. tuberculata*.

Pheropsophus curtus, Arrow, Trans. Ent. Soc. Lond. 1901, p. 204, t. ix. fig. 3 = *P. amœnus*, Chaud. Bull. Mosc. 1850, i, p. 78 = *P. marginalis*, Dej. Spec. Gen. i. 1825, p. 310 = *P. tripustulatus*, F., Ent. Syst. i. 1792, p. 145.

I have referred to all these before, but am only now able to refer them to one species. It seems unlikely that the Fabrician type came from Siam. I have seen no examples at present from any region other than Central and Southern India.

Brachynus concinnus, Bates, Ann. Mus. Civ. Gen. 1892, p. 393 = *B. longipalpis*, Wied. Germ. Ent. Mag. iv. 1821, p. 118.

In Bates's type the front fascia is divided on each elytron, interval 6 being dark, so that there is a patch on intervals 3-5.

Catascopus æneipennis, Chaud. Berl. Ent. Zeitschr. 1861, p. 118 = *C. hardwicki*, Kirby, Trans. Linn. Soc. xiv. 1825, 98. t. iii. fig. 1.

Catascopus cupricollis, Chaud. Col. Nov. i. 1883, p. 24 (for which I recently proposed the new name of *æneicollis*, Ann. & Mag. Nat. Hist. (9) iii. 1919, p. 481, now unnecessary) = *C. aruensis*, Saund. Trans. Ent. Soc. Lond. 1863, p. 458, t. xvii. fig. 5.

Catascopus goebeli, and var. *basalis*, Chaud. Rev. et Mag. Zool. 1872, p. 245.

I cannot regard these specimens, after a further examination, as anything more than varieties or local forms of *C. facialis*, Wied. In *basalis* the head, prothorax, and base of elytra are greenish, intervals 8-9 and apex very bright metallic green, sometimes a little cupreous. This is the usual form in Indo-China.

Tetragonoderus trifasciatus, Chaud. Bull. Mosc. 1850, ii. p. 455 = *T. tæniatus*, Wied. Zool. Mag. ii. 1, 1823, p. 62.

Cymindis altaïca, Bates (not Gebl.), Scientific Results of Second Yarkand Mission, Col. 1891, p. 20 = *C. mannerheimi*, Gebl. Bull. Acad. Pet. 1843, i. p. 36.

I saw both Gebler's types at Rennes. That of *altaïca* is larger and much more coarsely punctate than that of *mannerheimi*; the genæ also are larger and the sides of base of prothorax less oblique. Bates's specimen (which, however, I omitted to take to Rennes for comparison) is labelled "Kargil." It is true that intervals 3 and 5 are slightly narrower than the others, but the puncturation throughout is that of *mannerheimi*. There is a mark of interrogation on the label, though none appears in the memoir.

Lebia prattiana, Bates, Proc. Zool. Soc. Lond. 1889, p. 218, from Ichang, is an *Aristolebia*.

Lebia xanthophana, Bates, Proc. Zool. Soc. Lond. 1888, p. 38, from Kiukiang, and var. *nigrans*, Proc. Zool. Soc. Lond. 1889, p. 219, from Ichang, do not belong, as I anticipated they would do (Trans. Ent. Soc. Lond. 1923, p. 37), to the genus *Aristolebia*, but to the allied genus *Scalidion*.

LXVII.—*The Ancestrula of Membranipora pilosa, L., and of other Cheilostomatous Bryozoa.* By ARTHUR WM. WATERS, F.L.S., F.G.S.

[Plates XVIII. & XIX.]

WHEN references are used more than once, the following contractions are employed :—

1880. Hincks, Brit. Mar. Poly. (B. M. P.).
 1888. Jullien, Mission du Cap Horn (Cap Horn).
 1898. Waters, "On Membraniporida," Journ. Linn. Soc., Zool. vol. xxvi. (Memb.).
 1902. Harmer, "Morph. of the Cheil.," Q. J. Micr. Sc. vol. xvi. (Morph).
 1903. Norman, "Nat. Hist. of E. Finmark," Ann. & Mag. Nat. Hist. ser. 7, vols. xi., xii. (Finmark).
 1909. Levensen, "Morph. and Syst. Studies of the Cheil. Bry." (Studies).
 1918. Waters, "Mar. Bry. of Cape Verde Isl.," Journ. Linn. Soc., Zool. vol. xxxiv. (Cape Verde).
 1923. Waters, "Medit. and other Oribulinidae," Ann. & Mag. Nat. Hist. ser. 9, vol. xii. (Crib.).

For some time particulars of the ancestrulæ* and of the early growth of the Bryozoa have been noted, but, considering that *Electra pilosa*, L., had received so much study, it was taken for granted that the published descriptions told us all there was to be known. But, on re-examining the *Electra pilosa*, or a variety from the two adjoining towns of Santa Margherita, Lig., and Rapallo, on the Italian Riviera, points were discovered so different from any description with which I was acquainted that a prolonged examination was made, when light was thrown upon some problems of the early growth of the Bryozoa, giving a good starting-point for an explanation of other species. It occurs in great abundance on the fronds of *Posidonia* as delicate lines or strips, formed for the most part by two zoecia side by side (Pl. XVIII. figs. 1, 2, 3), and in principle has much in common with typical growth of the Cheilostomata. From the ancestrula of the incrusting Cheilostomata there is generally one zoecium growing from the distal end and one from each side, and it has been considered that the two lateral zoecia are the first formed, but this does not seem to be universal.

In the Santa Margherita *E. pilosa*, also found in Naples and Mentone, a distal zoecium is formed from the ancestrula

* I have referred to the ancestrula in (Cape Verde), p. 10; (Crib.), p. 108, and in other places.

and one lateral zoecium (always the left-hand one). This suppression of one side in all these specimens of *E. pilosa*, where many hundreds were examined, is very curious. It is, however, by no means the only case in which suppression of one side occurs, and in *Hippothoa hyalina*, L., Barrois, Jullien, and others figure the first zoecium as growing from the right-hand side; whereas I collected a considerable number from near Oban, Scotland, and with very few exceptions the first zoecium grows from the left, and the position is the same from Günther Sound, Franz Josef Land—from Plymouth it is sometimes right, sometimes left. Barrois*, speaking of *Hippothoa (Mollia) hyalina* says: "Dans la majorité des cas on ne rencontre jamais sur la loge primitive qu'un seul bourgeon latéral, néanmoins il arrive souvent qu'on trouve de l'autre côté de l'ouverture de la loge la trace d'un second bourgeon symétrique qui n'existe la plupart du temps qu'à l'état rudimentaire," and speaking of Alcyonidiens, p. 125, "Le bourgeonnement de la loge primitive est toujours latéral, et peut se faire tantôt à droit (figs. 26, 28), tantôt à gauche (pl. vi. fig. 27), mais dans tous les cas, l'un des deux bourgeons latéraux paraît avorter, du moins je n'ai jamais rencontré un seul cas, où ils existassent tous deux en même temps."

In *Membranipora pilosa* from Pontevedra, N. Spain (Atlantic), there are a few cases where there is suppression of one side (see Pl. XVIII. fig. 6), and in a specimen of *M. lineata*, L., there is suppression of the right-hand zoecium (Pl. XIX. fig. 15) in a young colony.

Cumings, in three very important papers on the ancestrula and early growth of Paleozoic Bryozoa, refers to the "suppression" of buds on one side in recent Cheilostomata, and says of the early stage of *Fenestella*†: "It consists in the formation of two lateral buds, and later of a median bud," which seems also to be the case in other Paleozoic Bryozoa. In *Fenestella* "the adult habit of growth is frequently not suggested until as many as fifty or sixty buds have been produced." In the Cheilostomata a gradual change to the adult is frequently met with, of which the most marked is *Membranipora*‡ (*Membraniporella*) *nitida*, Johnst., where for some distance, in certain cases, the early zoecia may remind us of *M. lineata*. The ancestrulæ of many of the Paleozoic forms seem to approach most nearly to the Cyclostomata,

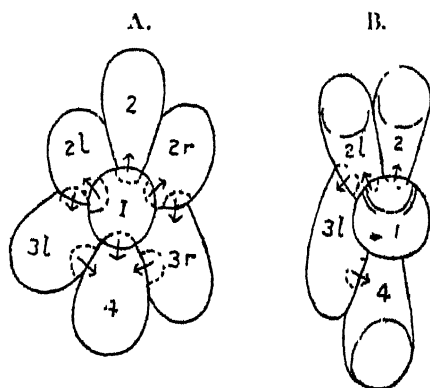
* 'Embryologie des Bryozaires,' p. 168, pl. ix. (1877).

† "Devel. of some Paleozoic Bry.," Amer. Journ. of Science, vol. xvii. p. 59 (1904).

‡ (Cape Verde), p. 10 (1918).

though in some points the way in which the buds are formed seems to recall the growth of the Cheilostomata. Cumings* gives the size of the protœcium of *Prasopora* and *Callopora*, Hall (non Gray), as being 0.08 mm., which is about the size of some of the smaller recent Cyclostomata. He† gives the size of the protœcium of *Fenestella* as 0.1–0.6 mm., which is larger than that of any known recent Cyclostomata. In a previous paper‡ he had given the measurement as 0.1 mm.—namely, the size of several recent species, which vary from 0.09–0.28 mm.

The typical growth (text-fig. A) from the ancestrula of incrusting Cheilostomata is, as mentioned, one distal and two lateral zoœcia, and in some species, or some individuals,



A. Type. Incrusting Cheilostomata.
B. Suppression of right zoœcium.

growth may take place all in one direction (Pl. XVIII. fig. 12), but very generally there is also a growth in the proximal direction, with frequently three zoœcia seeming to balance the three distal ones, forming a more or less radiate expansion, which is by no means so simple as it at first seems, and can be better understood after examining the Santa Margherita *Electra*, probably a variety of *Electra pilosa*, or may be a new species, to which we can now return, but, first, it will now be apparent that for comparative study of this

* "Devel. and Syst. Position of the Monticuliporoids," Bull. Geol. Soc. of Amer. vol. xxiii. pp. 358, 302 (1912).

† "Devel. of *Fenestella*," Amer. Journ. of Science, vol. xx. p. 171 (1905).

‡ "Devel. of some Palæozoic Bry.," Amer. Journ. of Science, vol. xvii. p. 59 (1904).

early growth the ancestrula *must be correctly orientated*, whereas most authors have neglected this and drawn it in any position. The zoecia growing proximally to the ancestrula do not, however, show the same regularity as the distal ones. There may be four or five proximal zoecia placed somewhat irregularly. The diagrams show where the growth-chambers must occur, but they will not be found all in one specimen, as in the diagram.

The ancestrula is more or less circular and has a plain calcareous front (Pl. XVIII. fig. 7), instead of the chitinous perforated front of typical *E. pilosa*. The aperture is oval, and the proximal border has a ridge; it is shorter than the other zoecia, both zoecia and aperture being about the same size as in the type. The ordinary zoecia have fewer perforations than *E. pilosa* from other localities, the shape of the ancestrula is somewhat similar with only two small distal spines—an unusual number; but Ostroumoff* mentions two with a similar ancestrula in *M. deliculata*, but we cannot be sure of the species. *Umbonula verrucosa*† has two (Pl. XVIII. fig. 14), like the “calcareous shoulders” of Harmer. Perhaps there are also two subsidiary ones, see p. 610.

Inside the ancestrula, as can best be seen from the dorsal surface, there are large chambers (Pl. XVIII. fig. 8), which I propose to call growth-chambers (text-fig. B, 2), from which the following zoecia are formed, one is distal, and in the variety there is one on the left side (2*l*), and sometimes, but not always, one on the proximal edge (4). This statement is not final, as there are irregularities, and a growth-chamber may be formed where no zoecium will afterwards grow. These chambers must be looked upon as somewhat akin to the pore-chambers, though much larger, and also larger than the rosette-plates, which occur on the side-walls of the zoecia. The distal (2) and lateral zoecia (2*l*) form the beginning of the distal part of the colony, and besides from near the base of the lateral zoecium (2*l*) another zoecium grows in an opposite direction, also from a chamber (3*l*, and figs. 1, 2). Continuing side by side with this is a proximal zoecium (4), which may become attached to the ancestrula; so that now we have a biserial strip (Pl. XVIII. figs. 1, 2) growing in each direction. There is thus a suppression of the row on the right-hand side, whereas in typical *E. pilosa* the budding generally occurs on each side (text-fig. A). This strip of *E. pilosa*, var., may grow in this way for a cou-

* Trans. from Russian, ‘Archives Slaves de Biologie,’ vol. ii. p. 565, “Etudes Zool. et Morph. de Bry.” (1886).

† (Morph.), p. 331.

siderable distance, and later may increase to three or four zoecia or more, and other strips may grow side by side with it, or in an opposite direction—also the strips may divide and again anastomose (Pl. XVIII. fig. 4). The later growth may look almost continuous, although arising from various centres, but of this I did not see much.

A lateral branch may sometimes grow at right angles to the colony from a growth-chamber, like those of the ancestrula, only one zoecium starting from this chamber, other zoecia spreading out as in the original growth (Pl. XVIII. fig. 3); also there may be, though very rarely, branching from the ancestrular region (Pl. XVIII. fig. 4), but it is not necessary to follow all irregularities. The early zoecia of these lateral branches are usually much larger than the others, whereas those near the ancestrula are usually smaller.

This variety gives the key to the growth of a large part of the Cheilostomata, showing the form of the ancestrula, and the position of the neighbouring zoecia.

The so-called spines of ordinary *E. pilosa* are really a continuation of the border of the chitinous wall, and it is very doubtful whether they should be compared with the oral and zoecial jointed or contracted spines, known in so many species. The number of these thorn-spines is remarkably variable in the different forms and varieties of *E. pilosa*, and also varies on the same specimen, for on some from Pontevedra, Spain, kindly sent to me by Barrosa, many of the younger zoecia are absolutely without these spines which are general on the older ones, becoming however fewer as the border is reached, also when there is a partial second layer there are few or no spines. The specimen described by Barrosa* from the same locality has many stout spines. A specimen from Plymouth has 10–12 of the zoecial thorn-spines and the ancestrula appears to have eight, but the central region is too much damaged to be quite certain of the number. In typical there may be only four or three, though some have five. The number of these thorn-spines cannot be trusted, either in the zoecia or the ancestrula, as a specific character, though in many species the number of spines has considerable value. They are somewhat like the spines of *Flustrellu hispida*, Fab.

In a specimen from Pontevedra one zoecium has two polypides, and the same thing occurs in a specimen of *Membranipora* (*Membraniporella*) *nilida*. In both cases they

* "Notas sobre Briozoos marinos españoles, XI," Bol. de la Real Soc. Españ. de Hist. Nat. p. 2, fig. 1 (1923).

occur in the zoecium proximal to the ancestrula (4 in diagram). I* have shown that *Membranipora armata* has in many zoecia two polypides, there are two in the zoecia of *Alcyonidium duplex*, Prouho, and in various Phylactolamata there are two at the commencement of a colony. Has the fact that zoecium 4 grows from the two sides anything to do with the two polypides?

As is well known, *Electra pilosa* commences as a Cyphonautes, and at an early stage it can be seen that the connection between the ancestrular zoecium and the bud is through a growth-chamber (Pl. XVIII. fig. 9). The Cyphonautes of *Membranipora villosa*, Hincks, produces a double primary, as described by Robertson†, and the same is the case in a form growing on *Macrocystis latifolia*, Bory, from Valparaiso, collected by the 'Challenger,' differing in having simpler and smaller spines, instead of the branched ones of *villosa*, also there are spines or protuberances on the basal side of each ancestrula (Pl. XVIII. figs. 10, 11), and on the frontal membrane there are a very few delicate "hairs," as described by Robertson. Mr. Kirkpatrick called my attention to this species.

These forms have some points of resemblance with *Flustrella hispida*, Fab.; and *Membranipora membranacea* seems to have a double ancestrula, as indicated by Nitsche‡, but the details of the figure and description require confirmation; Levinson's§ figure seems to show the growth more fully. I made an attempt to get some young colonies of *M. membranacea* sent to me, and since closing the paper have received some which I hope to find useful. They show a double primary, just like Pl. XVIII. fig. 11, but the details of the early growth are not yet worked out. I am also anxious to make further examination of *M. monostachys*, as there are many points of resemblance to *E. pilosa*. Some Phylactolamata have two zoecia to the primary, and it has been suggested that freshwater Bryozoa must be derived from marine forms. May we not find that *E. pilosa*, together with the *membranacea* group, has to be widely separated

* "Mar. Fauna Brit. E. Africa, Cheilostomata," Proc. Zool. Soc. London, p. 488 (1913).

† "Incrusting Cheil. Bry. W. Coast of N. America," Univ. of California Pub. Zool. vol. iv. p. 209, pl. xvi. figs. 22, 23, pl. xvii. figs. 24a, b, 25 (1908).

‡ "Ueber die Anat. und Entwickl. von *Flustra membranacea*," Zeit. wiss. Zool. vol. xxi. p. 25, pl. i. figs. 3, 8 (1871).

§ Danske Dyr, Musdyr. Zool. Danica, vol. iv. p. 54, pl. iv. fig. 8 (1891).

from the rest of the family known as the Membraniporidae, retaining those with a Cyphonautes and a tentacular organ.

The ancestrula and the early part of the colony is the most delicate region and is very frequently broken down when the rest is in perfect preservation, and thus sometimes there is uncertainty as to the exact number of spines. This damage of the central region makes the task of collecting particulars of the ancestrulae a very long and laborious one, and frequently our knowledge is based upon one specimen only, though there are a few species, such as *Microporilla malusii*, Aud., *Electra pilosa*, etc., which can be obtained in almost unlimited quantities; on the other hand, many species found in large quantities have not revealed their secret, especially in creeping forms. I have for many years wanted to see the earliest growths of *Childonia cordierii*, Aud., but though I have had a considerable quantity of the creeping stolou, it has not been possible to trace it to the first growth, nor have I seen the earliest stage of *Aitea*. Some of these will be best worked out in a zoological station.

The ancestrula of *Cellepora* has never been described, and I have long been on the look-out for it, and only last winter saw one for the first time in *Cellepora avicularis*, Hincks: and the cause of our ignorance is more or less special, though in a modified degree it occurs in many genera. A fresh super-layer grows over the older one and starts from near the ancestrula, thus burying it. The growth of these super-layers was alluded to in my paper on *Cribrilina**; Hincks† has referred to "super-cells" in *Schizoporella linearis*, var. *hastata*, Il., and others have mentioned the same thing. Canu and Bassler‡ speak of a "fausse" or "pseudoancestrula" to these super-layers.

Frequently it is difficult to follow the ancestrula, through its being partially overgrown by the proximal zoecium spreading over part of the ancestrula. *Microporella diadema* shows this well (figure will be given in subsequent part), and it is also seen in *Chaperia acanthina*, Q. & G. (Pl. XIX. fig. 4), in which I have shown, by dotted lines, the position of the covered ancestrula. Jullien§ has given a figure of the ancestrula of this species and Canu and

* (Crib.), p. 560.

† (B. M. F.), p. 252.

‡ "North Amer. Later. Tert. & Quat. Bry.," *Smithson. Inst. Bull.* p. 20 (1923).

§ (Cap Horn), pl. v. fig. 8.

Bassler* have reproduced it, but have given it upside down. Jullien makes the form of the ancestrula a family character in the Chaperidæ, but this is not yet proved.

Taking the Cheilostomatous ancestrula with a membranous front: first there are those with spines all round, such as *Membranipora lineata*, *M. dumerilii*, and *Schizoporella malusii*, *Cribrilina innominata*, *C. furcata*, Hincks, etc.; then are some in which the area is about three-quarters of the length of the ancestrula, as in the almost identical *Schizoporella vulgaris*, *S. spinifera*, *S. trichotoma*, Waters, *S. flabelligera*, Levinsen (Pl. XIX. fig. 3). Others with diminished opesia are *Mucronella microstoma*, Norm. (Pl. XIX. fig. 6), *M. præstans*, H., *Microporella diadema*, MacG., *Rhaphostomella scabra*, Sm.

The ancestrula, surrounded by special spines, have generally received the most attention, whereas it now seems that those without spines, but resembling mature zoecia, are probably the most numerous, but these must often be searched for, by following the growth of zoecia backwards to find the area of origin—a search often disappointing, as the early growth is the most fragile part frequently broken away or covered by débris, so that each addition to the list frequently represents prolonged work. However, it must not be overlooked that the ancestrula of *M. lineata* and *M. maderensis*, Waters, are almost identical with the mature zoecia. It would seem that the ancestrula frequently gives an indication of the structure of the future zoecia, the spines frequently having a relation to the zoecial spines.

Canu and Bassler† say, "In the Malacostega the ancestrula is analogous to the other zoecia, but smaller"—this, however, is not a quite satisfactory statement, as reference to *Chaperia* and the family *Membraniporidæ* will prove, also *Cribrilinidæ* shows the same thing, but many workers would remove this from *Malacostega*. Consideration of this had better be reserved until more species have been discussed. They go on to say, "In the *Anasca* there is more variety"; but the *Malacostega* are a part of the *Anasca*. From Levinsen's remarks‡ it would seem that he has examined many ancestrula of which no account has been published.

Although it is a very general rule in the incrusting Cheilostomata that there are three zoecia growing distally from the ancestrula, there are, however, some exceptions

* *Loc. cit.* fig. 3, B, 1923, p. 50.

† North Amer. Early Tert. Bry. p. 56 (1920).

‡ (Morph.), p. 18.

which will be considered when other species are discussed. Sometimes these differences are only individual—for instance, *Lepralia pallasiana* follows the rule, but I have seen one case where the zoecium, budding from the ancestrula, is followed by three zoecia, as if this solitary zoecium were an ancestrula (Pl. XIX. fig. 2). *Schizoporella areolata*, var. (Pl. XIX. fig. 1), shows a single zoecium from the spined ancestrula, and from this first zoecium two others grow. Only the one specimen is known.

The ancestrulæ of *Membranipora lineata* and its allies *M. dumerilii*, etc., present considerable difficulty, as often there are two or three very similar small zoecia surrounded by spines, so that it is difficult to decide which is the ancestrula, but with the facts just mentioned, where the ancestrula is followed by a somewhat similar zoecium, it was possible to find the explanation of some exceptional cases.

A comparative study of the ancestrula and early stages of the Bryozoa is likely to help us much in classification, but the voluminous attempts at re-classification have almost ignored this most important character. It may be expected to give more assistance in showing relationship, rather than in forming schemes of classification.

In the Cyclostomata* the size of the ancestrula is one of the most useful characters, but, as there is much similarity in other parts, we have not got very far, though no doubt the way in which the first few zoecia grow is important, and it was arising out of these considerations that I was anxious to see how far the ancestrula is useful in Cheilostomata. They have been mentioned in isolated cases, and in 1902 Harmer† published a list of 34 species in which they were recorded, but revision of these is now required. My list of recent Cheilostomatous ancestrulæ or early stages, about which more or less is known either from published descriptions or my own observation, is materially over 200, of which 109 are incrusting, and I am steadily adding to the number, which should be very considerable before I have finished. I estimate that I am entirely ignorant of the ancestrula in over 80 per cent. of the known genera. The sea-weeds thrown up on the coast in Mentone, San Remo, St. Raphael, and Santa Margherita have furnished many Cyclostomatous and some Cheilostomatous ancestrula, and

* * Waters, "Medit. Terna and Idmonea," Ann. & Mag. Nat. Hist. ser. 8, vol. x. p. 14 (1922).

† (Morph.), p. 321.

my general collection of slides has added many, and the British Museum collections a few. Some have been mentioned in fossils, but not often with much detail. Canu and Bassler, in their last works, mention several, but they are not always figured right way up.

There is a difficulty, which is more or less personal, for I am not at all satisfied with the present classification, and believe that far too many species have been made, and that differences in various parts of a colony would explain many species; also genera seem to have been too lavishly created, but, having been much out of England, away from my collection and books, during the last few years, it has been impossible to decide in many cases which genera of recent classification I can accept. Consequently many of the names of earlier authorities are used, without meaning that they will be retained, thus, intentionally, no indication is given as to any expected changes. However, in every case it will be easy to know what species is referred to.

The object of this study was to collect particulars of characters, which will largely help in checking and improving the classification, so that ultimately the bearing on classification must be considered. In this introductory part an effort has been made to bring out points useful in subsequent papers, and therefore we have not adhered to a few genera, though as a start, and as giving a good basis, forms belonging to what in early times was included in *Membraniporidae* have been specially considered.

*Membranipora** is the genus of Blainville, and he cites a number of synonyms, giving, first, *Discopora reticularis*, Lamk., a species which it is difficult to recognise; then come *M. reticulum*, Lamk., *M. teleucea*, Lamk., *M. corrugata*, Lamk. (as synonym with *Flustra lacroixii*, Aud.), *M. unicornis*, Flem. This does not seem to be *unicornis*, Flem., as described by Hincks, but *M. membranacea*, L. Of very few of these can we form any idea of what species is meant, and Blainville's figure of *M. reticularis* does not help us at all, but Savigny's *F. lacroixii* I should consider was *M. membranacea*, and, as is generally recognized, it is not what Busk described as *lacroixii*. Müller's description of *F. membranacea* seems to be *membranacea*, so I think are some others on Blainville's list—therefore it can be taken as the type of the genus. *Electra pilosa* has been placed under *Membranipora*, and having a *Cyphonautes* there are some points in common.

* *Man. d'Actin.* p. 447.

Then Busk in the 'Challenger' Report, p. 78, took the name *Electra** of Lamouroux and placed under it *G. cylindracea*, B., which is really *Chaperia*. He also included *E. pilosa*, L., *E. verticillata*, Lamx. *E. triacantha*, Lamx., *E. bellula*, Hincks, *E. distorta*, Hincks, to which Levinson adds *E. zostericola*, Nord., *E. amplexens*, Hincks, *E. monostachys*, Busk, *E. fossaria*, H., *E. catenularia*, Jam., *E. bicolor*, Hincks, *E. angulata*, Lev., which seems a very extraordinary collection.

Now *membranacea* and approximately all the group which I† called (4) *membranacea* have no ovicell or avicularia, and in some the first stage is known as *Cyphonautes*, and an intertentacular organ occurs also in *E. pilosa*, and many *Ctenostomata* have a *Cyphonautes* stage, which must generally be looked for. The spines of *M. pilosa* and several of its allies arise direct from the chitinous wall, resembling somewhat those of *Flustrella*. I have suggested (p. 599) that only *Electra pilosa* and *M. membranacea* can remain in the *Membranipora* group, retaining the name *Membranipora* for *membranacea*, and others will have to be re-classified.

Norman‡ has to a certain extent anticipated this, though not on the same grounds, and he says, when speaking of *Membranipora* and the type *membranacea*, "no other species placed in it by Hincks are congeneric or even belong to the same family."

Of the next group of *Membraniporidae*, *M. lineata*, the first species mentioned in Levinson's list of *Callopora*, seems typical. He puts it under *Callopora*, Gray, a name very unfortunately dug out by Norman, having been dead from 1848-1903, during which time it had been given by Hall (1852) to a very large and important genus of American Paleozoic fossils, and it is constantly occurring in the American and other literature. At the same time Norman created the genera *Alderina*, *Rhamphonotus*, and *Doryporella*, and Levinson§ placed these and *Amphiblestrum* under *Callopora*. Though I do not consider that all these genera were required, neither does it seem that all the species concerned can be placed in one genus. *Rhamphonotus* can be joined to *Amphiblestrum* and *Doryporella* can be removed to a distance.

* *Electra pilosa* has been made the type of a new genus, *Annulipora*, Gray, 1848, but *Electra* is much earlier (1816).

† "Membraniporidae," Journ. Linn. Soc. vol. xxvi. p. 665 (1898).

‡ (G. Finmark), vol. xi. p. 585.

§ (Studies), p. 150.

There are several species which have been puzzles, but perhaps the early growth will show us the relationship of *M. lacroixii* and many others.

I have two specimens like *Membranipora crassimarginata*, Hincks, from British Columbia, one of which, however, has two vicarious ovicularia, nearly as large as the zoöcia, but instead of the mandible being rounded, as described, it is obtusely triangular without a complete bar. The avicularian opening is very closely similar to that figured by Canu* in the Burdigalian fossil *Gramella crassimarginata*. *M. crassimarginata* has been placed under *Biflustra* and is the type of *Crassimarginatella*, Canu, 1900; *Oochilina*, Norm., 1903; and *Gramella*, Canu and Bassler, 1917.

The characters of *Crassimarginatella* are an umbonate ovicell and the shape of the mandible; while these characters are not sufficient, and not always present in the genus, yet a supplementary diagnosis would have enabled the genus to be retained.

Oochilina, 1903.—The most distinguishing character is the rounded vicarious ovicularium, but then Norman's *O. tensa* has an avicularium differently placed and of a different character.

Gramella, 1917.—The operculum closes the ovicell, there are no pore-chambers, and there is a vicarious avicularium.

Norman† considers that *M. valdemunita* is apparently referable to *Oochilina*. In a slide with four specimens there is only one avicularium, and the ovicell with a depression on each side would indicate that it must be placed elsewhere. I consider that *Membranipora solidula*, Hincks, is the same as *M. papulifera*, MacG., from Australia and New Zealand, but Norman thinks *papulifera* is apparently referable to *Oochilina*, whereas *solida* he puts under *Alderina*.

Membranipora crassimarginata seems subject to considerable variation, and a species largely based on thick walls is likely to give us difficulty. *M. crassimarginata*, var. *japonica*, Ortm., is separated on account of the perforated ovicell, whereas in the type it is usually cap-shaped, mostly with a groove in front. Marcus‡ describes the variety *japonica*, and I am in agreement with most of what he says, but am still of opinion that I was correct in considering the *perfragilis*, MacG., as much the same as *crassimarginata*, var. *erecta*, B., or both may be varieties, for though *perfragilis*

* "Bry. foss. des Terrains du Sud-Ouest de la France," Bull. Soc. Géol. de France, ser. 4, vol. xvi. pl. ii. fig. 2.

† (E. Finmark), vol. xi. p. 595 (1903).

‡ Bry. von den Juan Fernandez Inseln, p. 97 (1921).

usually shows more calcareous front wall at the proximal part, yet this varies in amount, as it does in var. *erecta*, and this so-called cryptocyst is not entirely absent in typical *crassimarginata*. My specimen of var. *erecta* is from Heard Island, collected by the 'Challenger,' and may be called a co-type.

I have also, from Port Phillip Heads, Australia, a very interesting specimen, which I had determined as *perfragilis*, having a decided calcareous wall in the proximal part, much as figured by MacGillivray, though I have never seen as large a lamina as figured by him; on this specimen is what I have called a "super-growth"—that is, a partial second layer. The zoecia in this second layer are much rounder, with thinner walls and without any underlying calcareous wall, so that the membranous front extends all across. It seems that this is part of the same growth as the under layer, and wherever possible these "super-growths" should be studied, as they may sometimes clear up obscure points. Though difficulties are presented by this "super-layer" *, I believe that my interpretation is correct.

In 1908 I† placed certain species of Membraniporidae in groups, based upon similarity of one or more characters, which seem to be related; however, it was in no way meant as a classification, whereas some people have taken my attempts as classification. It is only a first step towards it, and I flatter myself that it has not only been useful to me, but to many others when considering how classification could be improved. It has more appealed to me to keep on providing particulars of relationship, rather than to attempt classification, when we are so insufficiently acquainted with characters on which anything permanent can be built.

In the original Membraniporidae group there are spines round the ancestrula in :—

M. crassimarginata, H. Oval ancestrula, much smaller than zoecia; cannot be certain about spines.

M. craticula, Alder. Hincks mentions 9 spines (B. M. P. p. 147), and there are 9 in my specimens.

M. denticulata. 2 spines, Ostroumoff.

M. dumerilii, Aud. About 9 spines, Waters.

M. flemingii, Busk. 8–9 round the margin, Hincks; 10, Waters.

M. levata, Hincks (1)‡. 2 oral and 10 zoecial to the ancestrula, Waters, Hincks.

* (Orib.), p. 560 (1928).

† (Mem.), pp. 854–898.

‡ (1) indicates that only one specimen with ancestrula has been seen.

- M. lineata*, L. 8-9 spines. Ancestrula much resembles the ordinary zoëcia, Waters.
- M. maderensis*, Waters. About 10 spines, Waters.
- M. membrancea*, L. A double ancestrula, Nitsche, Levinsen.
- M. minax*, Busk. 11-12 spines, Hincks, B. M. P. p. 169.
- M. multispina*, Hincks. Band growing in opposite direction with suppression, Waters.
- M. pilosa*, L. Varying number of thorny spines, Waters; 5-8, Barrois.
- M. pilosa* var., W. 2 spines, Waters.
- M. rosselli*, Aud. (1). 6 oral spines to primary, none to other zoëcia, Waters.
- M. sophia*, Busk (1). 8 spines, Waters.
- M. tenuirostris*, Hincks. About 7 spines.
- M. trichopora*, Busk (1). About 12 ancestrular spines; by the third row of zoëcia there are about 7 spines, by the 5th two very long spines, several times as long as the zoëcia, Waters.
- M. trifolium*. Uncertain from notes whether the ancestrula has 3 or 6 spines, while, except a few near the ancestrula, the ordinary zoëcia have none, otherwise no difference.
- M. trifolium*, var., *minor* (1). 6 oral spines to primary, few afterwards.
- M. villosa*, Hincks. Double ancestrula, Robertson (Incrusting Bryozoa, p. 269).
- M. villosa*, probably var. (Pl. XVIII. figs, 10, 11), Waters. Double ancestrula.
- Chaperia acanthina*, Q. & G. (Pl. XIX. fig. 4). 7 spines.
- C. galeata*, Busk. 10 spines (Pl. XIX. fig. 8).
- C. judex*, Kirkpatrick (1). About 14 spines, not clear. Early zoëcia much smaller. To be figured subsequently.
- Membranipora (Membraniporella) melantha*, Busk (1). 4 spines, Waters. The type-specimen shows 4 very stout spines in the distal part of the ancestrula. Hincks, p. 203, says "no spines."
- M. (M.) nitida*, Johnst. Ancestrula 6 oral, 4 zoëcial spines. Hincks, p. 200, says 4 oral, 10 zoëcial, but it does not seem that he was examining the ancestrula, but a later zoëcium.

The following show no difference from ordinary zoëcia except usually being smaller, a very common character in the Cheilostomata:—

M. catenularia, Jameson (*Pyripora*).

M. lacroixii, Busk (non Aud.).

M. nodulosa, Hincks (1), Guernsey, 11. 10. 1. 622. Ancestrula same as other zoëcia, Waters.

There are some cases where more than one form of ancestrula has been mentioned; this may be from errors of observation, but this will by no means always be the explanation, and careful study is required where there are two forms. In *Microporella malusii** the difference is caused, as I have shown, by a calcified layer being formed in connection with the frontal membrane. All observations require examination and confirmation, as we are working with so few specimens, and these not always well preserved.

Membranipora (Cauloramphus) triangularis, Canu & Bassler, N. Amer. Later Tert. p. 48, a fossil almost identical with *Membranipora spinifera*, has 12 spines, pl. xxxiii. fig. 15. If we divided *Bugula*, *Bicellaria*, and *Scrupocellaria* into new genera according to the position of avicularia, where should we be, and similarly it would seem better to consider this as *Membranipora*. *Tegella*, Levinsen, shows the same tendency to make genera on slight differences, where specific distinction is sufficient.

Membranipora multispinata, Hincks. (Pl. XIX. fig. 9.)

This was at first called *M. pilosa*, var. *multispinata*, H. †, but afterwards Hincks ‡ gave it specific value. It does not seem to be closely related to *M. pilosa*, but to belong to the *M. corbula* group, as the spines are articulated, and not formed from the chitinous border. It grows as a narrow strip, with zoëcia side by side, directed in both directions from the point of origin. The ancestrula is not preserved, but was at (a). The suppression of one side is very similar to that of the variety of *M. pilosa*.

Chaperia judex, Kirkpatrick. *

The early stage will shortly be figured. This was first described as *Lepralia judex*, K. §, and afterwards called *L. acanthina*, Q. & G. ||. This has a different ancestrula to *C. acanthina* as figured by Jullien and by me (Pl. XIX. fig. 4); nor does it correspond with the ancestrula of

* (Orib.), p. 558.

† Ann. & Mag. Nat. Hist. ser. 5, vol. ix. p. (80), pl. v. fig. 6 (1882).

‡ Op. cit. ser. 6, vol. ix. p. 384 (1882).

§ Ann. & Mag. Nat. Hist. ser. 6, vol. i. p. 78, pl. viii. fig. 4 (1888).

|| Proc. R. Dublin Soc. n. s. vol. vi. p. 617 (1890).

C. galeata, Busk (Pl. XIX. fig. 8), so that it seems there are three species, the synonyms of which have been rather confused. The zoecial spines (usually 14–16) are more numerous than in *acanthina* or *galeata*.

*Mucronella microstoma**, Norman.

This is what Hincks described as *microstoma*, but if the genus *Phylactella* is to be retained then it would be *Phylactella*. *Mucronella* is not a satisfactory genus, and it is only left there provisionally. There is a row of pores round the border of the zoecium, then a ridge, and another row beyond, no doubt pores of connection, and this is what Norman described as a punctured crust. It is common in Santa Margherita and Rapallo, but, so far as I know, has not been previously mentioned from the Mediterranean.

Cribrilina furcata, Hincks. (Pl. XIX. fig. 5.)

This shows the chief characters of the *Pelmatoporina*, Lang; but there are about twice the number of pores as of *pelmae*, whereas Lang speaks in various places of there being the same number; however, in *C. punctata* there are more pores than nodules, and in *Puellina innominata*, var. *vicariata*, Waters †, there are usually about six pores to three nodules. The *ancestrula* has 11 spines round the membrane.

Umbonula verrucosa, Esper. (Pl. XVIII. fig. 14.)

It has at each side of the oral aperture a process directed distally, somewhat like a gouge. Busk ‡ speaks of a blunt tooth-like process here, and this is apparently what Harmer § in the text speaks of as "a pair of calcareous shoulders" and in the description of the figure as "distal wings," and says they "commonly bear avicularia." I have seen no avicularia except the suboral median one, either in my own collection from various localities or in the British Museum, and none have been described. Apparently Harmer had the *Mucronella soulieri*, Calvet ||, before him, a species found from various localities in the Mediterranean ¶, but not mentioned outside the Mediterranean. I am not sure of the source of Harmer's specimen.

* (B. M. P.), p. 370, pl. xxxviii.

† (Crib.), p. 550.

‡ Mar. Poly. p. 68, pl. lxxxvii. figs. 3, 4 (1854).

§ (Morph.), p. 382.

|| "Bry. Mar. de la Région de Cette," Trav. de l'Institut de l'Univ. de Montpellier. ser. 2, Mem. xi. p. 61, pl. ii. figs. 3, 4 (1902).

There are two similar gouged processes across the ancestrula (Pl. XVIII. fig. 11), and two others the shape of which is not exactly made out.

Hincks, describing British *verrucosa*, says, "in the littoral form the walls of the cell are very slightly calcified," but the specimens from the Laminarian zone thrown up on the shore from Rapallo and other places on the Mediterranean are strongly calcified.

Hippothoa hyalina, L. (Pl. XVIII. fig. 13.)

Jullien sent me the specimen figured as *Lepralia hyalina*, var. *hippethoa*. On the same slide there is also a uniserial specimen like his figures 1, 2, 4, and with ancestrula as figured by him. Are we to unite as one species forms with a closed calcareous ancestrula without spines and others with a membranous opesium surrounded by spines? If this difference is general, I think they must be specifically separated, but this will be dealt with when considering the Hippethoidea.

Hippethoa discreta, Busk.

Lepralia discreta, Busk, Mar. Poly. p. 85, pl. ci. figs. 3, 4 (1854).

Diazeuxia reticulans, Jullien (Cap Horn), p. 33, pl. iv. fig. 5.

Jullien gives *Lepralia hyalina*, var. *discreta*, Busk, as a synonym, but, then, why was there a reason for making the new species *reticulans*? It looks as if there were no pore-chambers, and as if the connection were by means of tubes, which is apparently the case in *H. bouganvillei*, d'Orb., and from Kerguelen in *H. hyalina*, var. *cornuta* and var. *muricata*, Busk.

Fragmentary specimens sent by Jullien as *Diazeuxia reticulans*, Jull., show these large connecting-tubes clearly without pore-chambers.

The ovicells are imperforate with an umbo, and are at the end of long ordinary zoecia. *Escharina brongniartiana*, d'Orb., has perforate ovicells on short female zoecia, and there are evidently connecting-tubes from which arise * erect chimney- or funnel-shaped tubes. While this stands alone in having these long shafts from the connecting-tube, yet something of the kind occurs in many genera where the bordering pores have some connection with the pore-

* Recent Bry. in d'Orb. Coll., Ann. & Mag. Nat. Hist. ser. 7, vol. xv. p. 10, pl. i. figs. 2-4 (1905).

chambers. Levensen* mentions that in *Lepralia* (*Crepid-
acantha*) *poissonii*, var. *crinispina*, Lev., "in the distal half
of the zoecium there is found 9-12 very long and thin mar-
ginal spines and a similar number of small quadrangular
uniporous pore-chambers (figs. 2, 3)." Which are the most
important characters in this difficult genus, the ovicells
perforate or imperforate; on short zoecia or on long
ordinary zoecia; the pore-chambers or the ancestrulæ?
Levensen gives a satisfactory figure of the pore-chambers
of *H. hyalina* in Mosdyr. Zool. Dan. vol. iv. pl. v. fig. 49
(1894).

EXPLANATION OF THE PLATES.

PLATE XVIII.

- Fig. 1.* *Electra pilosa*, L., var. Showing a strip growing in opposite
directions from the ancestrula, $\times 25$. From Santa Mar-
gheita, Lig.
- Fig. 2.* Ditto, $\times 25$. Young colony with one zoecium growing in an
opposite direction.
- Fig. 3.* Ditto, $\times 25$. Fresh branch growing from the side of the
zoecium and starting from a growth-chamber.
- Fig. 4.* Ditto, $\times 25$. Unusual form showing three branches growing
near the ancestrula.
- Fig. 5.* *Electra pilosa*, L., $\times 25$. Showing the normal growth of a
colony from the ancestrula. From Pontevedra, Spain.
Material sent by Barrosa.
- Fig. 6.* Ditto, $\times 25$. Showing a suppression of a zoecium on the
right-hand side. From Pontevedra.
- Fig. 7.* Ditto, var., $\times 85$. Ancestrula seen from the front. From
S. Margherita.
- Fig. 8.* Ditto, var., $\times 85$. Ancestrula seen from the interior. From
S. Margherita.
- Fig. 9.* *Membranipora*, $\times 50$. Cyphonautes. From Bournemouth. Pre-
paration given me by Mr. Henry, Waddington.
- Fig. 10.* Ditto, $\times 25$. Young colony of species closely resembling
M. villosa, Hincks-Robertson. Off Valparaiso, 'Challenger,'
21. 11. 27. 4.
- Fig. 11.* Ditto, $\times 25$. Double ancestrula.
- Fig. 12.* *Hippothoa hyalina*, L., $\times 25$. Young separate colony. From
Oban, Scotland.
- Fig. 13.* Ditto, Jullien, $\times 25$. From Baie Orange. Sent by Jullien,
marked "*hyalina*."
- Fig. 14.* *Umbonula verrucosa*, Esper, $\times 25$. Showing ancestrula sur-
rounded by zoecia. From Naples.

PLATE XIX.

- Fig. 1.* *Schizoporella eatoni*, var. *areolata*, Calvet, $\times 25$. Ancestrula
from which grows one zoecium, then others from this. Com-
plete small colony growing on weed with *Membranipora*
onychocelloides, Calvet. French Antarctic Exp.

* (Studies), p. 266, fig. 2, 3, text.

- Fig. 2. *Lepralia pallasiana*, Moll., $\times 25$. Ancestrula with single zoecium budding from it. Growing on steamer, said to have come from Venice, collected in Santa Margherita, Lig., N. Italy.
- Fig. 3. *Microporella subelligera*, Lev., $\times 50$. (1) Ancestrula part of mature colony. From Ischia, near Naples.
- Fig. 4. *Chaperia acanthina*, Q. & G., $\times 25$. Showing ancestrula partly covered by later zoecia; the position is indicated by the dotted line. From New Zealand.
- Fig. 5. *Cribriolina furcata*, Hincks, $\times 25$. From British Columbia.
- Fig. 6. *Mucronella microstoma*, Hincks, $\times 25$. Complete small colony. From Santa Margherita. Similar ancestrula seen on large colonies.
- Fig. 7. *Membranipora craticula*, Alder., $\times$ about 25. From sketch made in the Brit. Mus. (1) From Fianz Josef Land, 80.12.31.8.
- Fig. 8. *Chaperia galeata*, B., $\times 25$. Centre of large colony. From Port Elizabeth, S. Africa.
- Fig. 9. *Electra multispinosa*, Hincks, $\times 25$. Showing growth in opposite directions. From Australia, co-type, 97.5.1.491.
- Fig. 10. *Lepralia rectilineata*, Hincks, $\times 25$. Complete small colony, with the ancestral spines partly lost, so they are only figured on the right side. Probably about 20 spines. (1) From New Zealand.
- Fig. 11. *Membranipora dumerilii*, Aud., $\times 25$. The ancestrula is partly buried under subsequent growth. From Plymouth.
- Fig. 12. *Membranipora lineata*, L., $\times 50$. Centre of large colony. From Mentone.
- Fig. 13. *Membranipora sophia*, Busk. $\times 25$. Small young colony. From Gulf of St. Lawrence.
- Fig. 14. *Membranipora tenuirostris*, Hincks, $\times 25$. Central part of large colony. From Mentone.
- Fig. 15. *Membranipora lineata*, L., $\times 25$. Showing suppression of the zoecia on the right of the ancestrula. From Oban, Scotland.

LXVIII.—*Descriptions of Two new Species of Teinobasis (Odonata).* By the late HERBERT CAMPION.

Two old specimens of Agrionidæ in the British Museum (Natural History) belong to species of *Teinobasis* which appear to have remained unnoticed in the literature of the subject. In these species the wing-veins R_2 and M_2 originate close together, but without uniting, the former arising exactly at the subnodus, and the anal crossing lies considerably nearer to the second antenodal than to the first. They also agree in respect that in the male the upper branch of the superior anal appendages is conspicuously longer than the lower branch.

Teinobasis wallacei, sp. n.

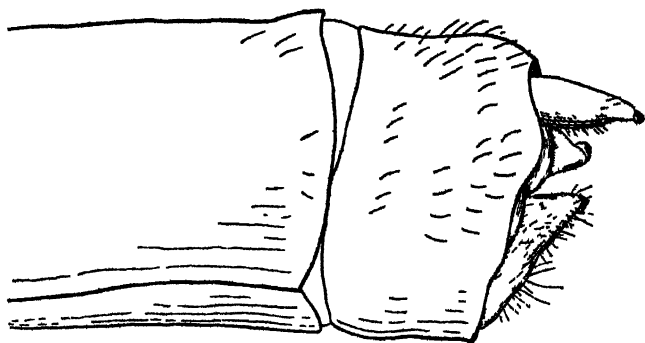
1 ♂ (holotype), New Guinea (N.W. end) (*A. R. Wallace*).
Length of abdomen 42.5 mm.; hind wing 25.5 mm.

Labium brownish white. Labrum orange-red, with a round blackish basal spot. Anteclypeus pale red. Postclypeus glossy blue-black. Genæ yellowish. Frons with an inferior orange-red band; frons superiorly and upper surface of head metallic blue-black. Occiput and back of head orange-red. Antennæ reddish brown.

Prothorax orange-red anteriorly, metallic blue-black posteriorly; the hind margin straight, not elevated.

Dorsum of meso-metathorax metallic blue-black, this

Fig. 1.



Teinobasis wallacei. New Guinea (*Wallace*). 68. 3.
Left lateral view.

colour barely passing below the humeral suture; sides orange-red. Interlar spaces yellowish.

Wings hyaline; venation reddish. Pterostigma very pale brown, with a whitish border all round. Postnodals $\begin{smallmatrix} 14.14 \\ 13.13 \end{smallmatrix}$.
Legs orange-red.

Dorsum of abdomen without definite colour-pattern, brownish or yellowish, with a low blue-black metallic lustre on most of the segments; 1-7 with a whitish basal ring or a pair of whitish basal spots; 7-9 with considerable non-metallic pale areas; 10 metallic blue-black; sides and ventral surface yellowish.

Anal appendages as shown in fig. 1; upper pair blackish; lower appendages yellowish.

This species comes very near to *Teinobasis metallica*, Först.,

the male anal appendages of which have been figured by Ris ('Nova Guinea,' ix., Zool. p. 487, fig. 8, 1913). The form of the appendages is quite characteristic in each of the two species compared.

Teinobasis aluensis, sp. n.

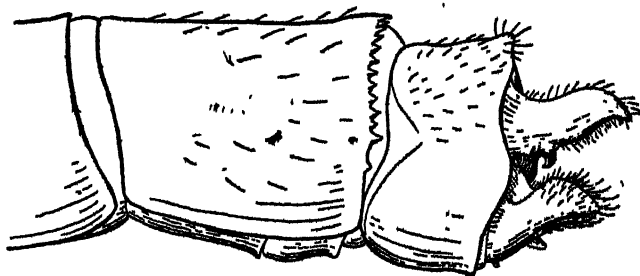
1 ♂ (holotype), Alu, Solomon Islands (C. M. Woodford).

Length of abdomen 48 mm.; hind wing 31.5 mm.

Labium yellowish white. Labrum dark green, bordered all round with reddish brown. Clypeus, genæ, and frons dark green. Upper surface of head bluish green. Occiput and back of head yellowish white. Antennæ reddish brown.

Prothorax olive-green, blackish in the middle; hind margin slightly rounded, not elevated.

Fig. 2.



Teinobasis aluensis. Alu, Solomon Islands (C. M. Woodford).
Left lateral view.

Meso-metathorax blackish on the dorsum, olive-green at the sides.

Wings hyaline; venation reddish brown. Pterostigma reddish brown, bordered all round with yellow. Postnodals $\frac{15.14}{16.14}$. The venation in the region of the arcus and nodus in both of the right wings is in a teratological condition, owing, apparently, to some injury received in an earlier instar.

Legs greenish yellow; spines black.

Abdomen above purplish black, with obscure (probably blue) pale markings, among which can be distinguished a pair of large spots on segment 1 and a narrow ring at the base of segments 3-7; the sutures between segments 8-10 yellowish. Sides of segments 8-10 greenish yellow. Under-side obscurely pale on segments 1-6, greenish yellow on 7-10.

Anal appendages as shown in fig. 2; yellowish.

LXIX.—*Reproduction of the Aquatic Oligochaete, Nais paraguayensis*, Mich. By K. S. PADMANABHA AIYER.

NAIS PARAGUAYENSIS has been found by me to be fairly common in tanks in Trivandrum, S. India. It is not a mud-dweller, but lives coiled round the roots of floating plants, particularly the herb *Pistia stratiotes*. When the roots of this plant are shaken to and fro in a basin of water, the worms are dislodged and swim about in characteristic snake fashion, justifying the appellation "Nais." The individuals examined by me varied in length from 10 mm. to 35 mm., and the number of segments also varied considerably. No sexually mature individual has yet been seen nor was a budding-zone present in any of the individuals examined.

Regarding the reproduction of this species, Professor Stephenson says (3):—"No budding-zone nor any sign of approaching fission has apparently as yet been observed in this worm, nor have sexual organs been seen. It is therefore a question how the animal ordinarily reproduces itself. I think it possible that it does so by simple fragmentation—i. e., without the formation of an internal budding-zone—and subsequent regeneration."

Among the specimens examined by me was one individual which measured only 5 mm. and had only twenty-five segments, with, in addition, a number of rapidly forming segments at the posterior end. The posterior region was normal, but at the anterior end, though the mouth and the prostomium were present, the first four setigerous segments (bearing only ventral setæ) of the normal individual were absent. Again, a short pharyngeal region was evident, but the narrow oesophagus of the normal individual was absent. Obviously, the specimen was one which had fragmented off from another and was in the course of regenerating a "head."

The specimen appeared to confirm Dr. Stephenson's view about reproduction in this species, but there was nothing to show that the fragmentation was not the result of an accident. In order, therefore, to get more satisfactory evidence, one specimen which I obtained later, and which struck me as unusually long (about 40 mm.), was isolated and left undisturbed in a glass dish of water. This individual had 164 segments, followed by a large number of newly forming segments in the posterior region. No change was observed for five days. Not even the faintest symptom of an approaching division was noticed. On the sixth morning, when the dish was examined, the worm had completely

divided itself into two, the division having taken place between segments 84 and 85. Both individuals were equally active. The anterior animal had already developed a short anal region (fig. 2) and anal respiration was going on. In the posterior animal, while a mouth and prostomium had been formed, the first four segments of the normal individual had not been regenerated (fig. 1). In about forty-eight hours the anterior individual had developed a large number of new

Fig. 1.

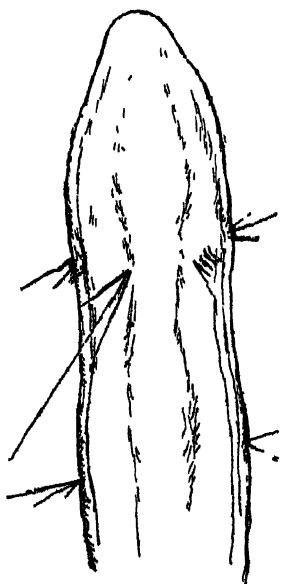
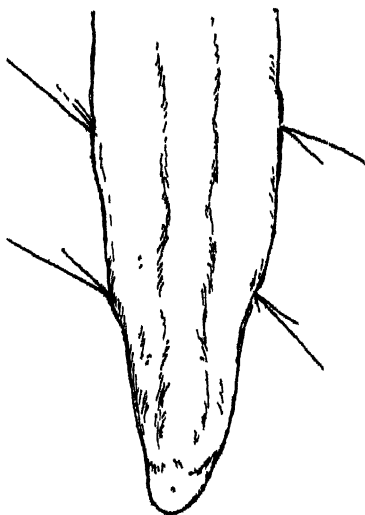


Fig. 2.



segments at its posterior end, and cephalization was complete in the posterior individual.

The above instance shows definitely that the normal method of reproduction in this species is, as Stephenson suspected, "by simple fragmentation and subsequent regeneration."

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- (1) STEPHENSON, J. *Memoirs of the Indian Museum*, vol. i. p. 203 (1909).
- (2) ——. *Fauna of British India: Oligochaeta*. London, 1923.
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LXX.—A new Genus of Pamphaginæ (*Orthoptera*) from the Angola Coast. By B. P. UVAROV, F.E.S.

A SMALL lot of insects collected at the Angola Coast by Mr. F. M. Penney, and presented by him to the British Museum, included two specimens—one of them immature—of a very large and bulky grasshopper, which, on examination, proved to represent an extremely aberrant new genus of the subfamily Pamphaginæ.

APHANTOTROPIS, gen. nov.

♂. Very stout, depressed, resembling in the general habitus certain genera of Timethini (particularly *Eremocharis*), and quite unlike in this respect any of the Pamphaginæ.

Antennæ filiform, very slightly compressed. Face practically vertical, very broad; frontal ridge very narrowly and very deeply sulcate above the ocellus, with an oval impressed dilatation at the latter, obsolescent below it. Vertex very broad, strongly sloping, not at all marginated. Lateral ocelli well removed from the eyes. Distance between the eyes very distinctly exceeds the vertical diameter of an eye. Pronotum very thick, depressed, with the disc inflated; median carina linear, sulcate in prozona, obsolete in metazona, which is a little longer than prozona, with the hind margin strongly projecting, semioval. Prosternum tumescent, with a narrow laminate tubercle on the anterior margin. Mesosternal lobes subtriangular, with the inner margins convex; their interspace distinctly broader than one of the lobes. Metasternal interspace quite as broad as the mesosternal one. Elytra and wings fully developed, their venation as in *Lamarchiana*. First abdominal segment with a large open tympanum; second segment below with obliquely striated stridulatory plate. Hind femora strongly compressed, with the upper and lower carina very high, laminate, serrate. Hind tibiae with an outer apical spine. Hind tarsi with the last joint inflated, pyriform.

Aphantotropis connectens, sp. n.

♂. Antennæ reaching a little beyond the prozona of pronotum, composed of elongated, slightly compressed joints. Face coarsely rugose and granulose. Fastigium of vertex flat, sloping, with the margins not at all raised, very broadly rounded; the surface of fastigium and of the whole

head granulose. Pronotum tuberculate and granulate, with the anterior margin obtusely angulate; prozona strongly gibbose, impressed on the sides near the anterior margin; metazona less strongly gibbose; median carina in prozona linear, sharply sulcate and convex in profile (owing to the convexity of the disc), in metazona obliterate; first and second sulcus obliterate on the disc; typical sulcus deep, placed distinctly before the middle. Elytra extending beyond the hind tibiae (their tips broken off). Front and middle femora compressed laterally, broader apically, with their upper margins wavy and the anterior genicular lobes roundly expanded. Hind femora about half as broad as long; the carinae as broad as the externo-median area; upper carina with its upper margin almost straight, strongly denticulate, each third to fifth denticle being somewhat larger than others; lower carina irregularly and obtusely denticulate. Supra-anal plate large, trapezoidal, with a shallow median sulcus triangularly widened in front; cerci rather large, somewhat compressed, tapering apically; sub-genital plate recurved, roughly oval in shape, with the apical margin narrowly reflexed and slightly notched in the middle.

Coloration (the type has been dried after having been preserved in alcohol) whitish ochraceous, mottled with brownish. Elytra with scattered indefinite blackish dots and small spots. Hind wings with the base probably yellowish in life; veins and veinlets in more than apical half blackish or brown. Hind femora with the lower inner sulcus black, with slight violaceous tinge. Hind tibiae yellowish (probably discoloured).

Total length 62 mm.; pronotum 25 mm. (prozona 11 mm.; metazona 14 mm.); elytron over 60 mm. (tips broken off); length of hind femur 28 mm.; maximum width of hind femur 15 mm.

Type and paratype (male larva of the last stage) have been taken at the River Hinamangando, S. of Cape St. Martha, Angola Coast (*F. M. Penney*).

The depressed pronotum, with a low median keel, which even disappears altogether in metazona, and the structure of fastigium make the insect to resemble so very closely certain of the *Imethini* that I was inclined at first to treat it as belonging to that group. However, the armed prosternum is of the Pamphagine structure, and the peculiar venation of the preradial field of elytra is exactly as in *Lamarckiana*, and I think that my new genus is a true member of Pamphaginae, though the structure of its head and pronotum is in direct disagreement with the accepted characters of the

subfamily. Indeed, the discovery of *Aphantotropis* reduces the differences between Pamphaginæ and Tmethini to the structure of prosternum only, a character which is not at all stable in both these groups. It is very noteworthy in this respect that *Methone*, which is supposed to belong unquestionably to Tmethini, has a distinctly denticulate prosternum; in the structure of the head (and also of the pronotum, which differs only in being truncate behind, as it must be expected in a wingless insect), as well as in the shape of hind femora and in the curiously inflated hind tarsi, *Methone* also agrees with *Aphantotropis*, so that their genuine affinity—not merely a similarity—is beyond doubt. Thus, we must see in *Aphantotropis* an ancient generalized form uniting the characters of Pamphaginæ and Tmethini, and wiping out the demarcation-line between the two groups so well defined in their typical representatives.

LXXI.—Two new Silurids from Lower Congo.

By EINAR LÖNNBERG, F.M.Z.S. &c.

WHEN classifying a small collection of Freshwater Fishes presented to the R. Nat. Hist. Museum in Stockholm by the Swedish Missionary, Mr. Börresson, I had the pleasure of finding the two new Silurids which are to be described below. They had been collected by Mr. Börresson in Lubosi river, a tributary to Luala river, Lower Congo.

Bagrus lubosicus, sp. n.

A *Bagrus* with short occipital process. Depth of body a little more than five times in total length (without caudal); length of head $3\frac{1}{2}$ times. Head $1\frac{1}{2}$ as long as broad, smooth above. Snout broadly rounded, subtruncate, $2\frac{1}{2}$ times in length of head. Eye $7\frac{1}{2}$ times in head, about $2\frac{1}{2}$ in interocular width. Occipital process narrow, hardly as long as eye, widely separated from first interneural bone. Mouth a little more than half as wide as head. Band of premaxillary teeth six times as long as broad, close to and nearly as broad as the crescentic band of vomerine teeth. Nasal barbel $\frac{3}{4}$ length of head. Maxillary barbel $2\frac{1}{2}$ length of head, reaching beyond vent. Outer mandibular barbel $\frac{1}{2}$ length of head, inner $\frac{3}{4}$. Dorsal I 8 (9), longest branched ray $\frac{1}{2}$ length of head, spine very weak. Adipose fin four times as long as deep, much longer than the base of the rayed dorsal and

nearly twice its distance from the same. Anal 11, eight rays branched. Caudal deeply forked, both lobes produced in long filaments. Pectoral $\frac{2}{3}$ the length of the adipose fin. Pectoral spine weak, its outer half articulated. The length of the caudal peduncle only $\frac{2}{3}$ of its depth.

Brown above with irregularly scattered small black dots, which are most numerous on the caudal and adipose fin, but also are seen on the back and sides—none, however, below the lateral line; whitish below. This form is closely related to *Bagrus ubangensis*, Blgr., but differs in several respects, as, for instance, through its larger head, shorter caudal peduncle, different proportions of barbels, eight branched rays in anal fin, &c.

The length of the specimen without caudal is 243 mm., the longest dorsal ray of caudal with its filament 123 mm.

Chrysichthys börressoni, sp. n.

Depth of body about $4\frac{1}{2}$ times in total length (without caudal); length of head not fully 3 times. Head much depressed, $1\frac{1}{2}$ times as long as broad, granular above; occipital process broad, in contact with interneural shield. Snout broadly rounded, truncate. Eye $1\frac{1}{2}$ times in snout, 5 times in head, $1\frac{2}{3}$ times in interorbital width. Mouth somewhat inferior, about twice in length of head. Pre-maxillary band of teeth curved, 6 times as long as broad. Vomero-ptyergoid teeth forming a long and narrow curved band, interrupted in the middle. Nasal barbel somewhat longer than eye; maxillary barbel a little shorter than head, when laid backwards reaching end of occipital process; outer mandibular barbel half as long as head, inner mandibular barbel a little more than three times in head. Gill-rakers long, 19 on lower part of anterior arch. Dorsal 16, its distance from end of snout not fully $\frac{1}{10}$ of its distance from root of caudal, its spine strong and serrated behind, second soft ray longest, somewhat shorter than head. Base of adipose fin about $\frac{1}{2}$ that of dorsal, from which it is separated by a space about equal to three times its base. Anal 13, 10 branched rays. Pectoral spine very strong with rather big teeth on its inner side, but also serrated on the outer. Caudal deeply forked with pointed lobes, the outer dorsal rays about three times as long as the middle ones. Caudal peduncle about $1\frac{1}{2}$ as long as deep. Brownish above, white below, a blackish spot at the upper end of the gill-opening. Total length without caudal 212, with the same 273 mm.

This species is probably related to *Chr. mabusi*, Blgr., but

differs from the same in many respects with regard to the proportions—for instance, larger head and eye, longer barbels, more numerous gill-rakers and anal rays, longer caudal lobes, &c.

I take the pleasure of naming it after the collector Mr. Börresson.

LXXII.—*Note on the Synonymy and Distribution of*
Tetranychus telarius, L. By STANLEY HIRST.

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Tetranychus telarius, L.

- Acarus telarius*, L., Syst. Nat. 10th edit. 1758, p. 616.
Trombidium telarium, Hermann, Mem. Apt. 1804, p. 40, pl. ii. fig. 15.
Trombidium tisserand (*Trombidium telarium*), Gervais, Ins. Apt. 1844, iii. p. 165.
Tetranychus russeolus, *T. telarius*, *T. urticae*, *T. viburni*, Koch, Deutsch. Crust. Myr. etc.
Acarus telarius, *A. cucumeris*, *A. rosarum*, *A. cinnabarinus*?, *A. ferrugineus*?, *A. tini*?, *A. mris*, Boisduval, Ent. Hort. 1867.
T. telarius (ad part.), R. Canestrini, Prospect Acarof. Ital. 1890, p. 433.
T. telarius (ad part.), Berlese, Acari etc. in Ital. rept. 1888, fasc. lvi. no. 6.
T. bimaculatus, Harvey, Ann. Rep. Maine Agric. Exp. Stat. p. 183.
T. althaeae, R. v. Hanstein, Zeitschr. f. wiss. Zool. 1901, vol. lxx.
T. althaeae, Trägårdh, Stockholm Medd. Centralanst. Forsöksv. Jordbruksom. 1915, p. 36.
T. althaeae, Zacher, Mit. K. Biol. Anst. Berlin, 1913, Heft xiv. p. 40.
T. ludeni?, Zacher, id. p. 40.
T. bimaculatus, McGregor, Proc. U.S. Nat. Mus. 1920, vol. lvi. p. 651.

In the tenth edition of his 'Systema' Linnæus gives the following description of *Acarus telarius*:—"14. *A. hyalinofulvus*. Fn. suec. 1212. 1196. Habitat in Europæ plantis, minus ventis expositis, caldario inclusis, tela ducens filis parallelis, quibus plantas suffocat; in Tilieæ foliis aversis autumnno frequens." Referring back to his 'Fauna Suecica' (first edition), we find that 1196 is called by him *Acarus alceæ*, of which he says:—"Habitat in Alcea, Malva rosea dicta, ubi sub foliis nascentibus progignitur, & inde a latere superiore palescunt folia." Whilst 1212 is "*Acarus viridialbicans* foliorum Tilieæ. De Geer. Habitat in foliis Tilieæ subtus, autumnno frequens." It is therefore clear that Linnæus included two distinct species of red spiders under the name *A. telarius*, one being the common red spider of

Europe, which is frequently found on *Alcea* (hollyhocks) and also prevalent in greenhouses, and the other the lime-tree or linden mite. In his 'Mémoire Aptéologique' (1804), Hermann clears up this confusion by creating the name *T. tiliarium* for the lime-tree red spider. He describes and figures *T. telarius* and *T. tiliarium* as separate species. Duges considers both *T. telarius* and *T. tiliarium* to be synonyms of the same species. Gervais, in his 'Insectes Aptères,' lists *Trombidium telarium* and *Trombidium tiliarium* as separate species, calling them respectively also *Trombidion tissand* and *Trombidion du tilleul*.

The genus *Tetranychus* was founded by L. Dufour in 1832 for *T. lintearius*, the species found on gorse, which therefore is the genotype. Dufour clearly had not collected specimens of *Trombidium socium*, *T. telarium*, and *T. tiliarium*, as he calls the previously described species. *T. lintearius* is regarded by Berlese in his *Acari* etc. in 'Italia reperta' as a synonym of *T. telarius*, but, as I have recently pointed out in my 'Revision of the English Species of Red Spider,' it is really a very distinct species. Koch, in Panzer's 'Deutschlands Insecten, etc.,' writes of *T. telarius* as occurring on red currant and many other plants. Canestrini, however, places *T. tiliarium* as a synonym of *T. telarius* in his 'Prospetto del Acarofauna Italiana.' He states that, owing to its variation in colour, vast geographical distribution, and occurrence on many different kinds of plants *T. telarius* has many synonyms. These remarks of Canestrini can only refer to the true *T. telarius* (*T. althææ*, v. Hanstein), and not to *T. tiliarium*, for the latter occurs on but few host-plants, has only one or two synonyms, and is not very widely distributed. In his *Acari* etc. in 'Italia reperta' Berlese considers *T. telarius* and *T. tiliarium* to be identical with one another. He figures the penis of *T. telarius*, however, as being strongly curved (plate v. fasc. 56), as in the true *T. telarius* (syn. *T. althææ*), whereas that of *T. tiliarium* is now known to be long, fine, and not curved. He also says that *T. telarius* occurs on many plants—a statement quite correct for the real *T. telarius*, but not for *T. tiliarium*. In 1915 Tjægårdh gives an account of *Tetranychus*, and considers *T. telarius* to be the lime-tree red spider and *T. althææ* to be a valid name. In his English summary, however, he declares that the lime-tree red spider is the common red spider. In this he is mistaken, for the real *Tetranychus telarius* (syn. *T. althææ*) occurs on very many different kinds of plants both in greenhouses and out of doors, whilst *T. tiliarium* has few host-plants. The penis of *T. telarius* is strongly curved, as in his paper on the taxonomic value of the

characters of the male genital armature of *Tetranychus* (Ann. Soc. Ent. America, vol. vi. 1913) is that of the true *T. telarius* (syn. *T. althææ*).

In his "Red Spiders of America" (Proc. U.S. Nat. Mus. 1920, vol. lvi.) McGregor gives a long list of synonyms under the name of *T. telarius*, most of which—for instance, *Acarus russulus*, *Acarus cucumeris*, *Acarus vitis*, *Tetranychus urticae*, etc.—are referable to the real *T. telarius* (*T. althææ*). McGregor remarks of *T. telarius*:—"Throughout Europe it is best known as the Linden-tree mite, from which host the specific name is derived." As a matter of fact, the name *telarius* means spinning, not linden. In Zacher's works on red spiders *T. telarius* is regarded as the lime-tree red spider, the real *T. telarius* being called by him *T. althææ*. We further find that *T. telarius* (*T. althææ*) is relegated by this author to a fresh subgenus *Epitetanychus*, although obviously congeneric with *T. lintearius*, Dufour, the genotype of *Tetranychus*. It is probable that *T. ludeni*, Zacher, is merely a slight variety of *T. telarius*.

I think it will be pretty clear from the above data that the older workers on this group, starting from Hermann, were right in allotting the name *T. telarium* to the common European red spider, and using the name *T. uliarium* for the so-called linden or lime-tree mite. Several recent workers, however, viz., Trägårdh, McGregor, and Zacher, have reversed this opinion, giving the name *T. althææ* to the common red spider and calling the lime-tree red spider *T. telarius*. It is a great pity that this mistaken change has been made, and it is to be hoped that the correct name, viz., *T. telarius*, will be used for the common red spider by future workers. This name is used in this sense already by many economic entomologists in Colonial reports and also in Great Britain. In any case, the name *althææ* cannot stand for the species of red spider found on hollyhocks, for there are many previous names.

In Great Britain *T. telarius* occurs on a great many different kinds of plants both in greenhouses and in the open. I have collected specimens myself on vines, beans, peas, strawberries, peaches, melons, cucumbers, tomatoes, *Euonymus*, *Nasturtium*, *Tropæolum*, *Oxalis floribunda*, *Laburnum*, *Robinia*, roses, cow-parsley, elder, guelder rose, *Dahlia*, sun-flowers, *Polyanthus*, *Convolvulus*, deadly nightshade, mint, dead nettle, mangel wurzel, potatoes, Solomon's seal, etc. The Museum has also received specimens of *T. telarius* (syn. *T. bioculatus*?) from the following plants in South India, viz., *Agathi*, *Castor*, *Clitorea ternatea*, *Aristolochia*, *Alysicarpus*

longifolius, *Argemone mexicana*, *Solanum nigrum*, mulberry, daincha (= *Sebania aculeata*), and on jasmine. Also on castor-leaves, Bagdad (Y. R. Rao). Also specimens from cotton in the Anglo-Egyptian Sudan (Bedford Coll.). It is probable that Ewing was correct in considering this species to be the common red spider of North America and that *T. bimaculatus* is a synonym.

LXXIII.—*Description of a new Agamid Lizard from Sumatra.* By H. W. PARKER, B.A.

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THAUMATORHYNCHUS, gen. nov.

Mouth large; teeth erect; incisors conical. Tympanum distinct. Snout ending in a long cutaneous appendage, not compressed. Body and tail compressed; body covered above with small, equal, obtusely keeled scales; caudal scales strongly keeled. A nuchal crest, not continuous with an indistinct dorsal one. A small gular sac; no transverse gular fold. No femoral or preanal pores.

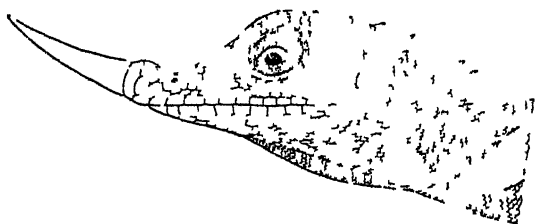
This genus is closely allied to *Harpesaurus*, Boulenger, which has no gular sac, the dorsal scales not keeled, and the rostral appendage compressed.

Thaumatorhynchus brooksi, sp. n.

Rostral appendage shorter than head, cylindrical, and slightly turned up; surrounded at the base by the rostral and four other scales. Head covered with rather large scales, largest on the supraocular region; all more or less definitely keeled. Canthus rostralis an angular ridge, the loreal region being almost vertical. Tympanum $\frac{3}{4}$ diameter of eye, subtriangular in shape. Twelve or thirteen upper, and eleven or twelve lower labials; gular scales keeled. Body strongly compressed; dorsal scales small, equal, obtusely keeled; laterals smooth; ventrals strongly keeled; dorsal crest represented by a rather indefinite row of larger keeled scales; nuchal crest of about seven small, separate, triangular flaps. Limbs long and slender; hind limb reaching the tympanum when adpressed, covered with keeled scales above and below. Tail long, two and one-third times length of head and body; compressed proximally, but almost cylindrical and very

slender distally; covered above and below with strongly keeled scales and without any trace of a crest.

Colour in spirit.—Brown above, with irregular and indefinite oblique lighter stripes on the sides. Upper head-scales tinged with pale blue, the colour forming more distinct patches on the supraocular regions, either side of the occiput, and in front of the tympana. Lobes of nuchal crest blue,



Thaumatorhynchus brooksi, gen. et sp. n. × 2.

and broad bluish bands present across both upper and lower arm and leg. Below, whitish marbled with brown. Tail pale blue in its proximal third, and thence with four broad, dark brown bars, separated from each other by three light brown bars of the same width.

[illegible]

Described from a single male specimen obtained by Mr. C. J. Brooks at Lebong Tandai, Res. Benkoelen Sumatra.

LXXIV.—*Brief Descriptions of new Thysanoptera.*—XIV.

By RICHARD S. BAGNALL, F.R.S.E., F.L.S.

THIS is continued from Ann. & Mag. Nat. Hist. ser. 9, xii. pp. 624-631, and the following forms are described:—

Desmothrips obsoletus, sp. n.

Archæolothrips fontis, gen. et sp. n.

Tetraceratotherium agrestis, gen. et sp. n.

Canothrips fallax, gen. et sp. n.

Teuchothrips hoodianus, sp. n.

Phraetia otha ips b. *acilunaga*, бр. п.

omei-coungi n. sp. n.

— *affinis*, sp. n.

Edemothrips propinquus, Bagn., var. *breviceps*, nov., and forma *obscuricornis*, nov.

Mesothrips brevis, sp. n.

— *froggatti*, sp. n.

— *insolens*, sp. n.

— *angusticornis*, sp. n.

— *karnyi*, sp. n.

Leeuwenia eugeniae, sp. n.

The hitherto undescribed ♂ of *Mesothrips lewisi*, Bagn., is described and some useful synonymical notes are added.

Suborder TEREBRANTIA.

Family Acolothripidae.

Subfamily OROTHRIPINÆ.

Genus DESMOTHRIPS, Hood.

1915. Proc. Biol. Soc. Washington, xxviii. p. 57.

Hood erected this genus for the reception of *Orothrips australis*, Bagn., separating it from *Orothrips* by the closely united antennal joints 5 to 9, the single sense-areas in joints 3 and 4, and the more slender body and wings. The genus is not yet represented outside Australia, and the fifth Australian species is described below.

Desmothrips tenuicornis (Bagn.).

Hub. AUSTRALIA, Victoria, 1 ♀, Burnley-on-Yarra, 24. 1. 23, on *Bursaria spinosa* (R. Kelly).

Desmothrips obsoletus, sp. n.

♀.—Length about 1.6 mm.

- Colour dark chestnut-brown, fore-tibiae, fore-tarsi, and antennal joints 3-4 pale, 4 a shade darker than 3. Forewings brown, pale area at base near scale, and another spot-like pale area before tip which does not reach the lower margin.

Maxillary palpi 7- and labial 4-jointed. Last four antennal joints closely united; 5 comparatively longer than in the known species. Approximate lengths of joints 3 to 9 as follows:—108 : 100 : 67 : 38 : 18 : 16. Wing-setæ minute.

This species is distinguished by its non-fasciate wings and the relatively long fifth antennal joint. The antennæ most closely approach those of *D. propinquus* (Bagn.), which, in addition to the shorter fifth joint and the dark and fasciate

wings, has the maxillary palpi 8-segmented. *D. australis* has the fourth joint of the antenna noticeably shorter than the third. *D. bagnalli*, Karny, is described as having the antennæ as in *propinquus* and the fasciate wings most nearly approaching those of *tenuicornis*.

Hab. AUSTRALIA, Brighton Beach, near Melbourne, 1 ♀, on *Mesembryanthemum* growing in sand, 1. xii. 23 (*R. Kelly*).

Subfamily *ÆOLOTHRIPINÆ*.

Genus *ARCHÆOLOTHRIPS*, nov.

♂.—With the characters of *Æolothrips*, but having the ninth abdominal segment simple, with the posterior angles not produced in the form of claspers. Palpi as in *Æolothrips*.

Type. *Archæolothrips fontis*, sp. n.

Archæolothrips fontis, sp. n.

♂.—Length about 1.1 mm.

Colour dark grey-brown, base of intermediate and hind femora pale; fore-legs light, outer margin especially shaded with dark brown. Antenna with basal joint light grey-brown; 2 and 3 pale, the latter dark grey-brown (concolorous with remaining joints) in the distal two-fifths or thereabouts, and 4 with a greyish spot near base.

Head apparently transverse and slightly longer than the pronotum. Antenna more than twice as long as the head; segments 5-9 closely and 6-9 compactly united, 5-9 together longer than 6. Relative lengths of joints approximately:—

2.	3.	4.	5.	6-9.
55	90	71	51	63.

Setæ on costa and veins of fore-wing minute. Abdomen with ninth segment simple.

Hab. AUSTRALIA, Healesville, Victoria, 1 ♂ in flowers of *Erythræa australis* with *Desmothrips tenuicornis*, 21. xii. 13 (*A. E. Shaw* and *R. Kelly*).

The simple ninth abdominal segment is common to the genera of the Orothripinæ in which the ♂ is known—namely, *Stomatothrips*, *Erythrothrips*, and *Orothrips*,—whilst the sensoria of *Desmothrips* are of the same general type as in the *Æolothripinæ*. Further, if the outline of the second joint of the maxillary palpus of *Æolothrips* be examined

under a high power, the form suggests that it has arisen from the completed fusion of five or six small joints, so that it is possible to picture a palpus substantially the same as in the *Orothripinæ* of to-day. It is only possible to conclude that the *Æolothripinæ* have thus been derived direct from the *Orothripinæ*.

Suborder TUBULIFERA.

Family Phlæothripidæ, s. l.

Genus TETRACERATOTHRIPS, nov.

♂.—Head long, about twice as long as broad; vertex overhanging, but not produced. Ante- and postocular bristles exceptionally long, the former forwardly directed one on each side of the anterior ocellus. Antennæ not twice as long as the head, joint 3 longer than any other, considerably longer than 4 and at least twice as long as the longest of the others; joints 4–6 with the apex obliquely truncate. Fore-femur stout and long, longer than the head; fore-tibia short and stout, sharply and inwardly bent near base; fore-tarsus with a stout tooth. Wings broad, not constricted near middle, and broadening distally; fore-wing with a large series of duplicated cilia. Tube long, cylindrical, constricted at apex, as long as the head; terminal hairs weak.

Type. *Tetraceratothrips agrestis*, sp. n.

This genus would seem to come near the Australian genus *Phaulothrips*, Hood, from which it differs in the long third antennal joint, the long tube, and the absence of lateral bristles behind eyes. *Phaulothrips* possesses a broad heavy abdomen, whilst the pronotum is strongly transverse, with the anterior margin deeply emarginate.

Tetraceratothrips agrestis, sp. n.

♂.—Length 4·7 mm.

Colour black, fore-tibia and tarsi brown; antenna with joints 2 and 3 yellowish-brown and 4 darker brown, others concolorous with head. Wings brownish medianly, almost clear distally.

Head about twice as long as broad, broadest near middle and faintly convergent posteriorly; eyes small, finely and smoothly faceted, and occupying only about 0·2 the length of the head. Vertex truncate, bristle on each side of the anterior ocellus forwardly directed and overreaching the apex

of the second antennal joint, postoculars similarly long and both pairs curved. Antenna with joint 2 noticeably longer than broad; 3 elongated, somewhat swollen near base and with outer margin between swelling and apex emarginate; 4 claviform, about 0.56 as long as 3; 5 about 0.7 as long as 4; 6 noticeably shorter than 5 and 7 shorter than 6 or 8. Pronotum about 0.6 the length of the head and 1.6 times as broad as long. Fore-wings broadest distally, where they are about one-tenth as broad as long; with more than 20 duplicated cilia.

Tube about as long as the head, practically parallel from near base to before apex, where it is suddenly constricted; terminal hairs weak and colourless, about 0.5 the length of the tube. Bristles of abdominal segment 9 about 0.75 the length of tube.

Hab. AUSTRALIA; 1 ♂, Austinmer, Carnoy, April 1914 (*Launcelot Harrison*).

Genus *CÆNOTHRIPS*, nov.

♀.—Head longer than broad; antennæ apparently 7-jointed, joints 7 and 8 being massed together and only separable by an oblique suture. Mouth-cone roundly narrowed, reaching to near base of prosternum. Fore-legs strongly incrassate and fore-tarsi armed in the ♀. Wings... Tube shorter than the head, stout, basally swollen and longitudinally carinate as in *Cænurothrips*, Bagn.

Type. *Cænothrips fallax*, n.

The genus would seem to come near *Mesothrips* in the incrassate fore-legs of the ♀, but differs in the closely united distal antennal joints and the form of tube, in which latter respect it agrees with *Cænurothrips*.

Cænothrips fallax, sp. n.

♀.—Length about 2.2 mm.

Colour dark chestnut-brown; fore-tibiae distally and fore-tarsi yellowish. Antenna with joint 3 yellowish-brown, 4 similarly yellowish in basal two-fifths, and 5 and 6 in the basal third or thereabouts.

Head 1.2 times as long as broad, broadest above middle; surface weakly reticulated; posterior ocelli on a line drawn across middle of eyes, anterior ocellus forwardly directed; postocular and other bristles apparently absent. Antenna

about 1·7 times as long as the head; joints 3 to 6 obconical, somewhat broadly truncate, and 4 clavate, with 3 somewhat longer than 4; 5 and 6 subequal and narrowed in their basal two-fifths and one-third respectively; 7 and 8 together about as long as 6, broad at base and roundly narrowed to apex. Mouth-cone reaching at least two-thirds across the prosternum; blunt at apex. Pronotum less than 0·5 as long as the head; strongly transverse and about 2·5 times as broad as long; seta at each hind angle brown, short, stout, and capitate, about 0·3 as long as the median length of pronotum. Fore-femora enlarged; fore-tibia short and stout and fore-tarsus armed with a large tooth. Other legs somewhat stout.

Abdomen a little broader than the pterothorax. Tube about 0·75 the length of the head and a little more than twice as long as broad at base, where it is broadest and longitudinally carinate to beyond the basal third; evenly narrowed from basal third to apex, where it is slightly constricted.

The wings are unfortunately folded down the back in the single preparation.

Hab. AUSTRALIA, Healesville, Victoria, 21. xii. 13; 1 ♀ in flower of *Erythraea australis* (A. E. Shaw and R. Kelly).

Teuchothrips hoodianus, sp. n.

♀.—Length 2·7 to 3·0 mm.

Colour uniform dark blackish-brown; fore-tibia except margins and fore-tarsi yellowish-brown. Antenna with joint 2 distally brown, 3 yellow with apex brown, and 4 and 5 with basal half and third respectively yellowish. Head 1·5 times as long as broad and 1·5 times as long as the pronotum; slightly roundly widened behind eyes to a line with the seat of postocular setæ, thence parallel. Surface reticulated. Eyes dorsally occupying about one-third the length of the head; postocular setæ well back, short and capitate, about as long as the width of an eye. Antenna about 1·75 times the length of the head; joint 3 much longer than any other, much as in *Tetraceratothrips agrestis*, n.; 7 and 8 massed together, suture oblique; joint 2 slightly longer but narrower than 1; 3 long, slightly outcurved near base without, and thence faintly emarginate, the corresponding inner margin as faintly arcuate. Relative lengths of antennal joints 2–8 approximately as follows:—

2.	3.	4.	5.	6.	7, 8.
48	120	76	62	46	63.

Pronotum transverse, setæ at hind-margin short, about 0.53 median length of pronotum, colourless, capitate. Fore-legs incrassate, tarsus with stout tooth. Wings faintly fumate, with over twenty duplicated cilia. Tube 0.8 the length of head, terminal hairs as long as tube; slender, colourless. Special ♂ setæ of abdominal segment 9 about one-third the length of tube, slightly fumate, capitate; other abdominal bristles colourless, capitate, the longest on segment 9 about 0.5 the length of tube.

This species is larger and has a longer head than any described species of *Teuchothrips*, whilst the long third antennal joint is also distinctive.

Dedicated to my friend and colleague J. Douglas Hood, one of our foremost Thysanopterists.

Hab. AUSTRALIA, Lake Tyers, Victoria; 2 ♂ ♂ on *Acacia elata*, 21. ii. 19 (*R. Kelly*).

Liothrips linearis (Bagn.).

Syn. *Compsothrips linearis*, Bagnall (Canary Islands).

Liothrips reuteri (Bagn.).

Syn. *Compsothrips reuteri*, Bagnall (Egypt).

The two species above cited undoubtedly belong to the genus *Liothrips*, falling in the same complex as *L. kingi*, Bagn., and *L. dampfi*, Karny. *L. reuteri* very closely approximates *L. dampfi*, but the latter appears to have a broader head and stouter third and longer fifth antennal joint.

Liothrips karnyi, nom. nov.

Liothrips reuteri, Karny, 1920, Acta Soc. Ent. Cech, xvii. p. 40, and 1921, Treubia, ii. p. 47.

The name must unfortunately be altered on account of the removal of *Compsothrips reuteri*, Bagn., to *Liothrips* above cited.

Liothrips seticollis, Karny, var. *obscuricornis*, Pr.

Hab. PARAGUAY, Asuncion, xii. 1904 (*Vezenyi*). Reg. 374.

Trybomia intermedia, Bagn., var. *fiebrigi*, Pr.

Hab. PARAGUAY, Asuncion, 16. v. 1905; Villa Morra (*Vezenyi*). Reg. 375.

Genus DICERATOTHRIPS, Bagn., 1908.

Syn. *Eulophothrips*, Schmutz, 1900, Ann. k. k. Naturhist. Hofmuseums, xliii. p. 278.

Although I have known of this synonymy for some time, I do not appear to have published it. Karny includes *Diceratothrips* in his *Cryptothripinae* and *Eulophothrips* in his *Maclothripinae*.

Genus PHRASTEROTHRIPS, Priesner.

Priesner erects this genus for a species which would have otherwise been included in *Gynaikothrips*, the chief character lying in the generally heavier form. Karny includes Schmutz's Brazilian species *Smerinthothrips tropicus* in his most recent table of *Gynaikothrips*, thus sinking *Smerinthothrips* as a synonym. It may be that Priesner's species and those now described are congeneric with Schmutz's species, forming a complex of generic rank, in which case Priesner's genus would fall as a synonym of *Smerinthothrips*, but meanwhile I describe the following species under Priesner's generic name:—

Phraстерothrips brasiliensis, sp. n.

♀. This species differs from *P. conducans*, Pr. (Paraguay), in the shape of the head, which is broadest behind eyes, converging slightly posteriorly, whilst the outline of the eyes converges very rapidly anteriorly. The third antennal joint is broadly clavate and scarcely more than 1.5 times as long as broad, and joint 6 is much shorter than 5 and approximately the same length as 7. The two setae at each posterior angle of pronotum are long and colourless, and set close together as in *conducans*. The tube is only about 0.75 the length of the head, about twice as long as broad at base, and only 0.4 as wide at tip as at base. The terminal hairs are weak, colourless except at base, and slightly longer than the tube. Abdominal bristles long, those on 7 and 9 the longest, the longest pair on the latter being distinctly longer than the tube. Wings with 16–17 duplicated cilia.

Larva.—Larva yellow, with bands of strong crimson hypodermal pigmentation.

Hab. BRAZIL, per J. Omer-Cooper. Tube no. 67.

Phrasterothrips omer-cooperi, sp. n.

♀.—Length about 1·9 mm.

Dark chestnut-brown, fore-tibia (and sometimes extreme end of femur), and all tarsi yellowish. Antenna with basal joint concolorous with head; second lighter distally; 3 pale yellow, with light greyish shading distally; 4 and 5 yellow basally, light greyish-brown in distal half; 6–8 greyish-brown, with 6 clear yellow basally.

Head about 1·2 times as long as broad behind eyes; eyes large, occupying 0·4 the length of the head; cheeks convergent posteriorly (subparallel in one specimen); postocular bristles short, about as long as the width of an eye. Antenna with joints 3 and 4 broadly claviform; 6–8 slender, with 7 subcylindrical and with stem-like constriction basally; relative lengths of joints approximately:—

24 : 38 : 54 : 48 : 50 : 46 : 39 : 27.

Sense-cones long.

Pronotum about 0·6 as long as the head; antero-marginal setæ well-developed; mid-lateral long, placed well forward, those at hind angles as long as the median length of the pronotum, the inner placed on a higher plane than the outer, and thus away from margin. Fore-wings fumate, with (?) 8 duplicated cilia.

Tube slender, 0·8 as long as the head, at least twice as long as broad at base and twice as broad or more at base than breadth at apex; evenly narrowed, without distal constriction. Terminal hairs weak, colourless distally, and practically as long as the tube. Abdominal bristles long, colourless, those on 7 and 9 longest, and the longest pair on 9 as long as tube.

♂.—Pronotum smaller and narrower and the tube shorter.

Larva.—The larva is yellow, without crimson hypodermal pigmentation.

Hab. BRAZIL, per J. Omer-Cooper of Cambridge, to whom I have pleasure in dedicating the species. Tube no. 79.

Phrasterothrips affinis, sp. n.

♀.—Near *P. omer-cooperi*, m. Apex of fore-femur clear yellow as well as fore-tibia and tarsi. Antenna with joints 3 and 4 clear yellow; 5 similarly yellow, very lightly tinged with grey-brown distally; 6 light grey-brown and 7 darker grey-brown distally, yellow basally; 8 wholly grey-brown.

Head shorter (6:7) than in *omer-cooperi*, about 1.1 times as long as broad; postocular bristles longer, as long as the length of an eye. Antenna with joint 3 clavate, not so broad as in *omer-cooperi*, 4 not clavate but shaped like 5; terminal joints not so slender. Relative lengths of joints approximately:—

22:37:47:40:44:44:42:27.

Pronotum 0.7 the length of head; antero-marginal setae vestigial, others as in *omer-cooperi*. Fore-legs stouter than in *omer-cooperi*.

Tube about 0.85 the length of head, terminal hairs as long as the tube, and the longest bristles on segment 9 1.35 times as long as the tube.

♂.—Like the ♀. Head and pronotum shorter, the latter more strongly transverse. Relative lengths of antennal joints 6-8 as follows;—35:38:26. Fore-legs shorter and stouter. Tube shorter, but having the same relative length compared to the length of head.

Hab. BRAZIL, per J. Omer-Cooper. Tube no. 79.

Edemothrips propinquus, Bagn., var. *breviceps*, nov.

♀.—Length 2.0 to 2.1 mm.

Whole of body deep black-brown. Apart from its larger size and deep coloration of body, this form differs from *propinquus* in having a broader and shorter head, being but 0.74 (as compared with 0.87) times as long as broad. The cheeks are distinctly convergent posteriorly. The tube is not so broad at base, being 1.55 times as long and 0.5 as long as broad at base. The postocular setae are longer, whilst the pronotal and abdominal setae are longer and noticeably stronger.

A form—*obscuricornis*, mihi—may be characterized, having the distal half of antennal joint 3 and all the succeeding joints of a uniform dark brown.

O. propinquus, Bagn., was described from Australia (Healesville, Victoria), and the above form is the first-described *Thysanopteron* from New Zealand.

Larva.—The larva of the first instars are deeply coloured throughout with a crimson hypodermal pigmentation; the last abdominal segments, the head, tibiae, and basal parts of femora are grey. The antenna is also grey, with distal joints darker. The hairs are exceptionally long, with those on

terminal abdominal segments 5.0 times as long as the segments bearing them, but in the later stages are relatively shorter. In the last instar the hypodermal pigmentation is lost and the body is uniformly yellowish, with the same parts more or less dark grey-brown as in the earlier stages. The first antennal joint is almost colourless, 2 and 3 pale, 4 brown, and 5 and 6 dark blackish-brown; 3-5 are claviform, with a distinct sense-cone on outer, inner, and outer margin respectively; the sixth and last joint is bulbous in its second fifth or thereabouts; the parallel stem and bulb (which is furnished with a sense-cone) representing joint 6 and the prolongation joints 7 and 8 of the imago.

Hab. NEW ZEALAND, Nelson, on apricot (*E. S. Gourlay*), 26. viii. 24, per Dr. R. J. Tillyard. I.B.E. 140.

Malacothrips lewisi (Bagn.).

Trichothrips lewisi, Bagnall, 1914, Ann. & Mag. Nat. Hist. ser. 8, xiii. p. 80.

This Japanese species should undoubtedly be referred to the genus *Malacothrips*, the shape of the head agreeing very closely with *zonatus*, Hinds (U.S.A.), and *modestus*, Bagnall (St. Vincent).

Malacothrips hispanicus (Bagn.).

Cephalothrips hispanicus, Bagnall, 1916, Ann. & Mag. Nat. Hist. ser. 8, xvii. p. 409.

This is more fittingly placed in *Malacothrips* than in *Cephalothrips*. Known from Spain and the Himalayas.

Genus *MESOTHRIPS*, Zimm.

Syn. *Arrhenothrips*, Hood, 1919, Insec. Inscit. Menstr. vii. p. 98.

When describing *Arrhenothrips ramakrishnae*, an Indian species affecting *Mimusops elengi*, Hood laid stress on the reversal of the secondary sexual characters, stating that "In no genus of the group, however, are the fore-legs and prothorax of the female enlarged and swollen; it is invariably the male which possesses these characters." This, however, is not so, as the Australian genera *Horistothrips*, Morgan, 1913, and *Eurynothrips*, Bagnall, possess the enlarged prothorax and fore-legs to a remarkable degree in the ♀, as also other Australian and Oriental gall-causing Thysanoptera. The genus *Mesothrips* now includes several species very

diverse in form—minute species with the head quadrate or transverse, and larger species with longer heads varying considerably in shape, as witness *indicus*, Bagn., *jordani*, Zimm., *leeuweeni*, Karny, and *lewisi*, Bagn. Though the genus may ultimately be split up with advantage when the material that is coming to hand has been properly digested, I think it desirable meantime to keep them together and to include *Arrhenothrips ramakrishnæ*, which appears to come nearest to *M. lewisi*.

Mesothrips lewisi, Bagn.

♂.—The male, apart from being very much smaller, differs in having the fore-legs normal in size and not strongly incrasate. The pronotum is also small, about 0·6 the length of the head and 1·8 as broad as long. The tube is 0·7 the length of the head.

The original description refers to the female.

Mesothrips brevis, sp. n.

Length, ♀, 1·6–1·7 mm. ; ♂, 1·4–1·6 mm.

This species closely resembles *M. parvus*, Zimm. The head is always lighter in colour than the rest of the body, varying from yellowish-brown to brown; the last two antennal segments are shaded with grey to greyish-brown, with 5 sometimes shaded distally; the intermediate and hind tibiae are usually pale at knees, whilst the tube distally is not so deeply coloured as the rest of the body. The fore-wings are of a uniform greyish-brown, and have from 8–10 duplicated cilia, as compared to 6–7 in *parvus*.

The head is as long as broad or very slightly broader than long, whilst the antennae are twice as long as the head, compared to 1·75 times in the length in *parvus*. The postocular setae (short and very thick in *parvus*) are moderately developed and pointed, being about as long as the breadth of the eye. The relative lengths of the antennal segments are approximately 24:36:45:42:41:40:32:21, with segment 8 conical and broadly united to 7; segment 4 is broader than 2 and noticeably broader than 3 or 5. In *parvus* joint 2 is broader than 3, whilst 3 to 6 are subequal in breadth; 2 is twice as long as 1 and equal to 4 in length, whilst 3 is only slightly longer and is subequal with 5 and 6.

The pronotal and abdominal bristles are not as long and stout as described in *parvus*, those of the abdominal segment 9 being but 0·65 the length of the tube. The tube is about 0·1

longer than the head in the ♀, and the same length as the head in the ♂.

Hab. CEYLON, several ♀♀ and 2 ♂♂ galling pepper (*E. E. Green*), with *Androthrips flavipes*, Schm., as an associate. Reg. 217.

Mesothrips froggatti, sp. n.

Length, ♀ 1.7–1.85 mm.; ♂, 1.5 mm.

Colour chestnut-brown; tube, last abdominal segments, margins of head and thorax more deeply coloured; fore-tibiæ and all tarsi yellow. The antennæ with basal joints concolorous with head, 3 lemon-yellow and the others greyish-to yellowish-brown, the apical joints being probably darker; fore-wings very faintly fumate, almost clear. Mouth-cone reaching across prosternum. The antennæ have collapsed in all the preparations; the intermediate joints are not long, whilst the third joint is obconical, with the apex broadly truncate.

Postocular bristles and all those on the pronotum present, long and slender, colourless. Pronotum as long as the head and twice as broad as long; bristles at posterior angles 0.65 as long as the median length of the pronotum. Fore-femora strongly incrassate; seta on fore-coxa more than usually long. Intermediate and hind tarsi with a minute tooth near apex within. Pterothorax transverse, converging posteriorly.

Abdomen about as broad as width across the fore-coxæ, abdominal bristles very long, those on 9 being about as long as the tube. Tube a little more than 1.2 times as long as the head, evenly narrowed to distal fourth or thereabouts, and then more strongly to apex; terminal hairs very slender, colourless except at base, and difficult to see; actually longer than the tube.

The antennæ and wings of the preparations at my disposal are unfortunately impossible to describe.

♂.—Slightly smaller, but closely resembling the ♀.

This species differs from *parvus* and *brevis* in the shorter head, the almost colourless wings, and in the coloration of the antennæ. The long setæ and bristles, and, more especially, the full complement on the pronotum, are noteworthy.

Hab. AUSTRALIA, Penshurst, near Sydney, forming galls on terminal leaf-buds of *Callistemon* sp., both sexes (*W. W. Froggatt*).

Mesothrips insolens, sp. n.

♀.—Length 1.1 mm., breadth of abdomen 0.4 mm.

Colour dark brown, including tarsi; fore-wings brown; hind-wings light grey-brown. Antenna with joint 3 yellowish, darker distally; 4 brown, yellowish in basal two-fifths or thereabouts; 5 similarly brown, yellowish basally; 1, 2, and 6 to 8 dark brown, concolorous with body.

Head widest near base, about as long as broad across middle; surface subreticulate; postocular setæ developed about as long as width of eye, blunt. Antenna about twice as long as the head; intermediate joints short, less than twice as long as broad; 3 and 4 obconical, with apices broadly truncate (there is only one preparation with antennæ which is imperfectly displayed). Mouth-cone reaching across prosternum. Pronotum about 0.7 as long as the head and twice as broad as long; setæ developed, short, stout, and truncate at apex. Fore-leg incrassate, tarsus with a sharp tooth. Pterothorax strongly transverse. Wings without duplicated cilia.

Abdomen broad, segment 8 with sternite semicircularly produced; lateral bristles on 7-9 long, with ends truncate; the longest on 9 about 0.65 the length of the tube. Tube about 0.75 the length of the head, with the terminal hairs colourless distally and about 0.85 the length of the tube.

♂.—Smaller. Head distinctly transverse, prothorax and fore-legs smaller, and tube about as long as the head.

Hab. AUSTRALIA, Healesville, Victoria, both sexes on leaves of myrrh (*Leptosperm myrsinoides*), Jan. 1917. Reg. 356 (*R. Kelly*).

Mesothrips angusticornis, sp. n.

♂.—Length about 3.1 mm.

Dark brown; fore-tibæ and all tarsi yellowish; antennæ with joints 1 and 5-8 dark chestnut-brown, 4 brown but not quite so dark as 5-8; 2 brown, shading to yellow-brown distally, and 3 yellow lightly tinged with brown.

Head about 1.35 times as long as wide, widest across base of eyes, where the eye is in outline slightly hump-like; eyes occupying 0.3 the total length of head; cheeks converging very slightly to basal third, and thence as slightly widening

again, weakly spinose; postocular bristles long and slender, surpassing anterior margin of eyes. Antenna not quite twice as long as the head, with joint 1 stout, 2 slender; 3, 4, and 5 long; 3 only mildly claviform, wider than 4, which is in turn wider than 5; 6 much shorter than 5. Relative lengths of joints 3-8 approximately as follows:—

79:82:79:55:44:37.

Mouth-cone reaching across the prosternum. Pronotum 0·65 the length of the head; antero-angular and mid-lateral setæ, as well as those at posterior angles, rather long and slender, those at posterior angles being 0·5 to 0·6 the median length of the pronotum. Fore-femora incrassate, longer than and about 0·7 as wide as the head; tibia somewhat short and stout, and tarsi with a stout tooth. Fore-wings lightly fumate, with over 30 duplicated cilia.

Tube stout, very slightly longer than the head; terminal hairs about 0·7 the length of the tube; the longest bristles on abdominal segment 9 nearly as long as the tube.

Distinct in the form of the eye and the long intermediate antennal joints. Comes nearest to *M. karnyi*, sp. n.

Hab. CEYLON, Peradeniya; 1 ♂, swept from bushes (*E. E. Green*). Reg. 223.

Mesothrips karnyi, sp. n.

♀.—Length about 2·6 mm.

This species comes nearest to *angusticornis*, m., in form and colour. The antennæ have joints 1 and 6 to 8 concolorous with the head, 5 a little lighter brown, 3 yellow, and 4 yellowish-brown.

The head is 1·4 times as long as broad, with the checks practically straight, not narrowed near eye; eyes small and normally shaped, occupying laterally only 0·18 the length of the head. Postocular bristles long. Antennæ with joints 3 and 4 claviform and 5 subclaviform, the relative lengths of the joints 2-8 being approximately as follows:—

45:70:67:60:49:40:29.

Pronotum very short and transverse, only about 0·22 the length of the head, and 2·65 times as long as broad; antero-angular bristles apparently vestigial, mid-lateral present and those at hind angles 0·7 as long as the median length of the

pronotum. Tube stout, 2·3 times as broad at base as at apex; as long as the head in one specimen and 0·97 as long in the other; terminal hairs 0·65 as long as the tube, and the longest bristles on abdominal segment 1·2 times as long as the tube.

Easily separated from *angusticornis* by the shape of the eyes and head, the short and differently shaped intermediate antennal joints, and the coloration of the antennæ. Both species come near to *indicus*, Bagn., which, however, is a larger species, with a shorter head and much longer tube.

Hab. INDIA, Dehra Dun, base of West Himalayas; 2 ♀ ♀, under dead seeds of dead pods of *Albizia lebeck*. Reg. 165 a.

Family Hystriothripidæ.

Leeuwenia coriaceus (Bagn.).

Syn. Panurothrips coriaceus, Bagnall.

This species differs from *gladiatrix*, Karny, in the much more slender, fewer, and evenly backwardly directed setæ of the tube, by the form of the longer head, which has the cheeks parallel-sided, and by the vestigial bristles (very short in *gladiatrix*) at the anterior angles of the pronotum.

Leeuwenia eugeniæ, sp. n.

Form, size, and colouring much as in *coriaceus*; fore-wings faintly fumate, clear distally, with a grey-brown streak running into the distal third. Cheeks converging anteriorly. Antenna with joint 4 shorter and noticeably broader than 3; 5 approximately as long and broad as 4; 6 about 0·8 as long as 5, and 7 and 8 together longer than 5.

Tube very slender, not quite as long as abdominal segments 1-9 together; setæ minute, fine and recumbent, much shorter than the breadth of the tube, and thus differing from Karny's recent species.

The species differs from *convergens*, Flood (genus *Hoodiella*, Karny), in the shape of the head, the coloration of the antennæ, tibiæ, and wings, and the relative lengths of the antennal joints. I reserve a fuller description upon the type of *indicus*, Bagn., becoming available for study.

Hab. INDIA, Kodaikanal (*Pulneys*); both sexes and larvæ on *Eugenia* sp., 11. v. 19 (*Ramakrishna Coll.*). Reg. 335.

INDEX to VOL. XIV.

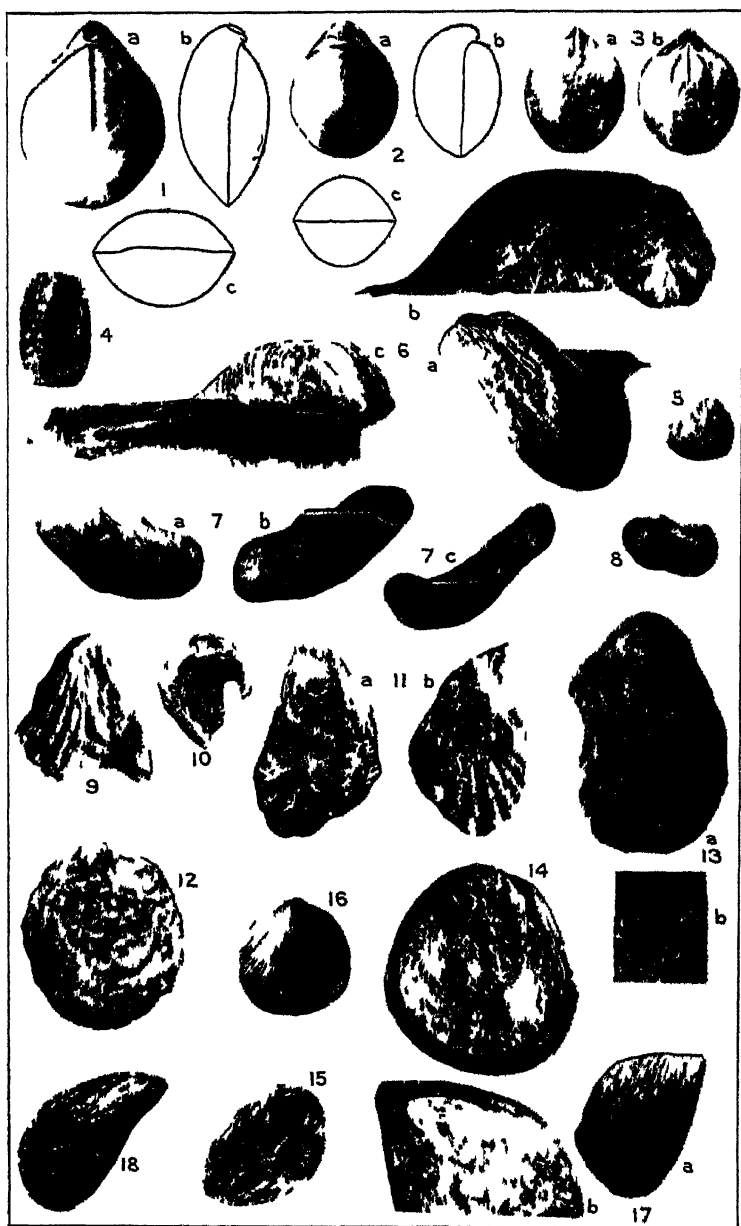
- ACANTHALIOTUS, characters of the new genus, 184.
 Acanthia, new species of, 447.
 Acrididae, notes on, 96.
 Acronycta, new species of, 312.
 Adisura, new species of, 310.
 Agrias, new species of, 147.
 Aiyer, K. S., reproduction of the aquatic Oligochaete *Nais paraguayensis*, 615.
 Alæna, new species of, 130.
 Alexander, O. P., on new or little-known Tipulidae, 289, 457.
 Amphineurus, new species of, 297.
 Amphipod, new, 233.
 Andrena, new species of, 179.
 Andrewes, H. E., on Oriental Carabidae, 241, 585.
 Auentmetus, characters of the new genus, 585.
 Anobiidae, new, 345.
 Anthomyia, new species of, 269.
 Aphantotropis, characters of the new genus, 617.
 Arachnocampa, characters of the new genus, 177.
 Archæothrips, characters of the new genus, 627.
 Aronicola, notes on, 453.
 Asterias, new species of, 499.
 Atherigona, new species of, 518.
 Aves, notes on, 317.
 Bagnall, R. S., on fossil Thysanoptera, 156, 625.
 Bugrus, new species of, 619.
 Banksiola, characters of the new genus, 216.
 Bathycosmia, new species of, 428.
 Bethune-Baker, G. T., on new African Rhopalocera, 130.
 Bezzi, M., on a new species of *Gitona*, 254.
 Bibliographical notices, 343, 574.
 Bryant, G. E., on new species of *Phytophaga*, 217.
 Bryozoa, notes on, 594.
 Burmesia, new species of, 85.
 Burton, M., on the genus *Chondrilla*, 206.
 Bythoscopinæ, new, 529.
 Crenocara, new species of, 373.
 Calappa, new species of, 227.
 Callianassa, new species of, 122.
 Callicebus, new species of, 286.
 Calman, W. T., on an abnormal specimen of the edible crab, 326.
 Campion, H., on two new species of *Teinobasis*, 612.
 Camptolenæ, new species of, 247.
 Campylomma, new species of, 444.
 Carabidae, new, 241, 585.
 Carcharoda, new species of, 314.
 Carcinus, two abnormal chelæ of, 136.
 Carinogammarus, new species of, 284.
 Cephalopoda, new, 127.
 Ceicopides, new, 477.
 Cetola, new species of, 312.
 Chutocapsus, new species of, 442.
 Cheesman, R. E., and Hinton, M. A. C., on mammals from the desert of Central Arabia, 548.
 China, W. L., on the Hemiptera-Heteroptera of Rodriguez, 427; on a new genus of *Bythoscopinæ*, 529.
 Chironomus, new species of, 573.
 Chloriden, new species of, 310.
 Chondracris, characters of the new genus, 105.

- Chondrilla*, notes on, 206.
Chrysichthys, new species of, 620.
Cicada, new species of, 452.
Cirripedia, notes on, 318; phylogeny of the, 533.
Cirrodes, new species of, 314.
Cirroteuthis, new species of, 127.
Clerada, new species of, 435.
Coccinellidae, new, 531.
 Cockerell, T. D. A., descriptions and records of bees, 179, 274, 577.
Ocenothrips, characters of the new genus, 629.
Coleoptera, new, 247, 315, 531.
 Collin, J. E., on *Diptera* (*Cyclorhaphia*) from Spitsbergen, 201; on *Diptera* from Jan Mayen Island, 204.
Conepatus, new species of, 286.
Corrodentia, new, 486.
 Cox, I. R., on a Triassic fauna from the Jordan Valley, 52.
Crocidura, new species of, 500.
Crustacea, new, 121, 225.
Crustacea Branchiopoda, notes on, 559.
Cucumaria, new species of, 113.
Cyana, new species of, 308.
Cyrtacanthacrinii, revision of, 96.
Cyrtacanthacris, new species of, 101.
Decapod Crustaceans from Washington State, U.S.A., 121; from *Anguilla*, 225.
Delopsia, new species of, 570.
Desmothrips, new species of, 620.
Dialroica, new species of, 251.
Dicranomyia, new species of, 289.
Diptera, notes on, 201, 204; new, 162, 175, 254, 257, 289, 513, 568.
Disonychia, new species of, 250.
Dorcatoma, new species of, 376.
 Edwards, F. W., on *Diptera Nematocera* from Spitsbergen, 162; on the "New Zealand (fly-worm)," 175; on new species of *Nematoceros* *Diptera* from Fiji and Trinidad, 568.
Egumba, characters of the new genus, 135.
Eicochrysops, characters of the new genus, 132.
Emmesomyia, new species of, 260.
Empheri, new, 245.
Engonoceros, new species of, 504.
Eccephalothrips, characters of the new genus, 161.
Epamara, new species of, 181.
Eriopus, new species of, 311.
Eteone, notes on, 153.
Eublemma, new species of, 315.
Eudryas, new species of, 313.
Euselasia, new species of, 281.
Falsogastrallus, new species of, 357.
Finotina, characters of the new genus, 104.
Fishes, otoliths of, 130; new, 619; notes on, 253.
 Frost, G. A., on otoliths of fishes from the Upper *Kimmeridgian*, 130.
Galerucella, new species of, 252.
 Geological Society, proceedings of the, 189, 511, 576.
Gorbilius, new species of, 551.
Gitona, new species of, 255.
 Goldschmidt, E., on a new *Asterias* from Chile, 400.
Gouomyia, new species of, 209.
 Gurnoy, R., some notes on the genus *Apus*, 550.
Gynoplistia, new species of, 302.
Ilagnella, characters of the new genus, 215.
Halictus, new species of, 581.
 Harding, W. A., on new *lechea* from India, Burma, and Ceylon, 489.
Helobdella, new species of, 492.
Hemiptera, new, 427.
Hemithrips, new species of, 159.
Heterocera, new, 306.
Heteroptera, new, 427.
 Hinton, M. A. C., on a new species of *Crocidura* from Scilly, 509; see Cheesman, R. E.
 Hirst, S., on some new species of red spider, 522; note on the synonymy and distribution of *Tetranychus telarius*, 621.
Hirudinea, new, 480.
Homoptera, new, 520.
Hydrophoria, new species of, 514.
Hylaeus, new species of, 275, 577.
Hylemyia, new species of, 263.
Hypocyma, new form of, 131.
Ilema, new species of, 307.
Ischnorhinus, new species of, 174.
Ischnothrix, new species of, 301.
Jaculus, new species of, 556.
 Karny, H. H., on a new *Empheri* from Uganda, 245.
Kraussaria, characters of the new genus, 101.
 Kuwayama, S., see Okamoto, H.

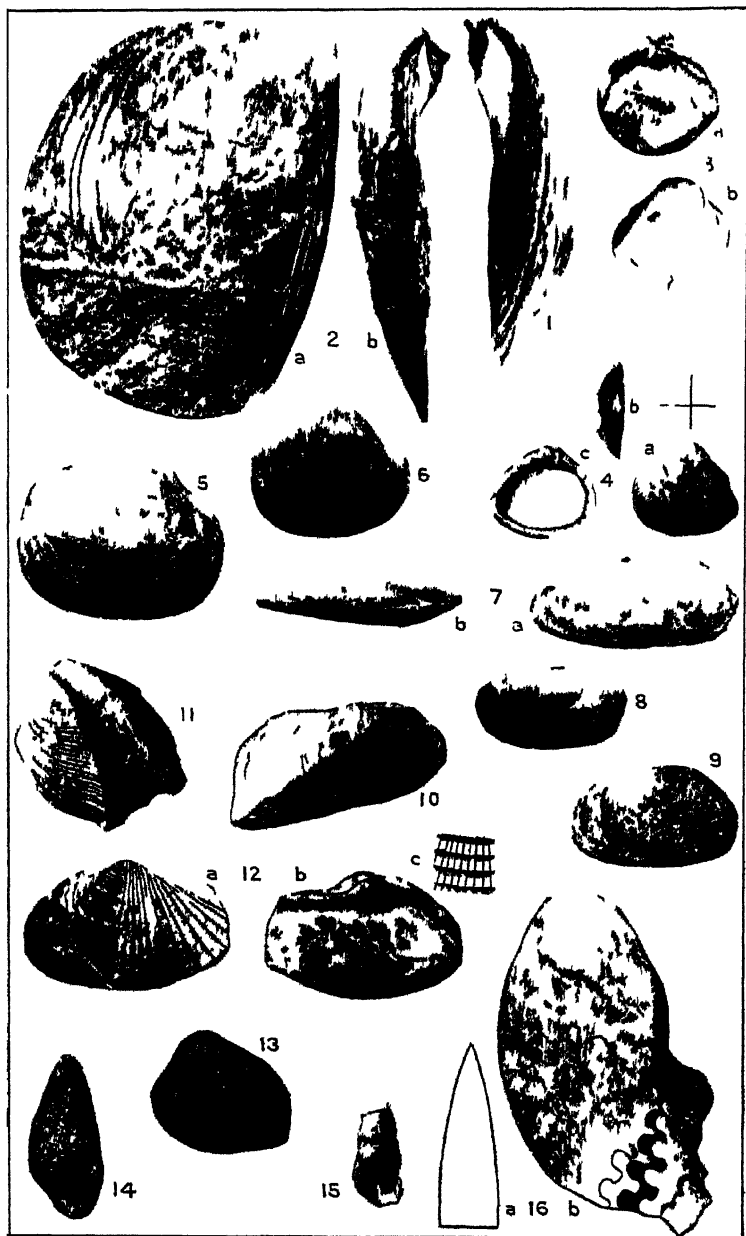
- Laccogrypota, new species of, 478.
 Lallemand, V., notes sur les Cerco-
 pides de l'Amérique Centrale et
 Méridionale, 477.
 Lathy, P. I., notes on the genus
 Agrias, 144; on the iridescent
 species of Eusclania, 248.
 Lebidia, new species of, 244.
 Leeuwenia, new species of, 640.
 Leiomyia, new species of, 570.
 Lemmus, new species of, 180.
 Lepidoptera, new, 144, 283.
 Lethreus, new species of, 434.
 Leucovia, new species of, 315.
 Libnotes, new species of, 571.
 Liparidæ, new, 502.
 Litæa, characters of the new
 genus, 438.
 Longitarsus, new species of, 249.
 Lonnberg, E., on two new Silurids
 from Lower Congo, 619.
 McIntosh, notes from the Gatty
 Marine Laboratory, St. Andrews, I.
 Malloch, J. R., on exotic Muscaridæ,
 257, 513.
 Mammals, new, 143, 186, 286, 509,
 528, 548.
 Martynov, A. V., preliminary re-
 vision of the family Phrygaenidæ,
 209.
 Massy, A. L., note on a new Cepha-
 lopod, 127.
 Meek, A., and B. Storrow, on a
 pelagic phase of *Arenicola marina*
 and of *Uteone arctica*, 453.
 Meggitt, F. J., and Saw, M. P., on a
 new tapeworm from the duck,
 324.
 Meriones, new species of, 553.
 Mesocoropus, new species of, 366.
 Mesothæ, new species of, 362.
 Mesothrips, new species of, 636.
 Metadorcatoma, characters of the
 new genus, 378.
 Metathæca, characters of the new
 genus, 418.
 Mezira, new species of, 430.
 Micronecta, new species of, 451.
 Mirotsternus, new species of, 369.
 Molophilus, new species of, 292.
 Moneophora, new species of, 480.
 Monod, Th., on a new species of
 fresh-water Amphipod, 243.
 Monroe, C. C. A., on the post-larval
 stage in *Diopatra cuprea*, 193.
 Muscaridæ, new, 257.
 Mycetophilidæ, new, 175.
 Myers, G. S., on the existence of the
 Japanese killifish, 253.
 Myophoropsis, new species of, 82.
 Nannophryganea, characters of the
 new genus, 212.
 Nematocera, new, 102, 568.
 Neolaccogrypota, characters of the
 new genus, 478.
 Nesothæca, characters of the new
 genus, 386.
 Nodina, new species of, 248.
 Nyctinomus, new species of, 456.
 Nygmia, new species of, 502.
 Odonata, new, 612.
 Oecomys, new species of, 287.
 Oedemothrips, new species of, 634.
 Okamoto, H., and Kuwayama, S., on
 the Corrodentia-fauna of South
 Saghalien, 486.
 Oligochæta, new, 546; notes on,
 615.
 Orectocera, characters of the new
 genus, 521.
 Orthellia, new species of, 519.
 Orthocladus, new species of, 170.
 Orthoptera, notes on, 96, 617.
 Oryzomys, new species of, 143.
 Otolithus, new species of, 140.
 Otonycteris, new species of, 549.
 Paraclepsis, characters of the new
 genus, 495.
 Paratetanychnus, new species of, 524.
 Parathæca, characters of the new
 genus, 423.
 Paratuerta, new species of, 315.
 Parker, H. W., on a new Agamid
 lizard from Sumatra, 624.
 Pearson, H. S., on a Seymouria-
 morph reptile, 333.
 Perionyx, new species of, 546.
 Perkins, M., on two abnormal chelæ
 of *Carcinus maenas*, Pennant, 130.
 Petalium, new species of, 300.
 Phascogale, new species of, 528.
 Phorodonta, new species of, 569.
 Phrasterothrips, new species of, 632.
 Phronia, new species of, 104.
 Phrygaenidæ, revision of the family,
 209.
 Phryganopsis, characters of the new
 genus, 211.
 Phryganopteryx, new species of, 309.
 Phyllotreta, new species of, 249.
 Phytophaga, new, 247.
 Pipistrellus, new species of, 549.
 Placabdella, new species of, 493.
 Platypus, new species of, 545.

- Plicatula*, new species of, 37.
Pogonoscopus, characters of the new genus, 529.
Polychæta, notes on, 2, 193, 453.
Polymoria, new species of, 300.
Pontobdella, new species of, 400.
Prophryganea, characters of the new genus, 210.
Procus, new species of, 487.
Pylloneura, new species of, 245.
Ptinidæ, new, 345.
Ptinus, new species of, 348.
Ranina, new species of, 125.
Raoiella, characters of the new genus, 522.
Regina, characters of the new genus, 215.
Reptilia, new, 338, 624.
Reubenia, characters of the new genus, 61.
Rhopalocera, new, 130.
 Rothschild, Lord, on some Madagascar and African Heterocera, 300; notes on *Lophoceros jacksoni* and *L. deckeni*, 317.
 Ruedemann, R., on the phylogeny of the Cirripedia, 533.
 Sampson, W., on a new species of *Platypodidæ*, 545.
 Saw, Maung Po, see Meggitt, F. J.
Sciara, new species of, 568.
 Scott, H., on *Ptinid* and *Anobiid* Coleoptera from the Seychelles, 345.
Seymus, new species of, 532.
Serpulidæ, notes on, 1.
 Sigard, A., on *Scymnus nouveau* de Mexique, 531.
Sicola, new species of, 308.
Simulium, new species of, 572.
 Spath, L. F., on a new *Ammonite* from the Gault of Folkestone, 504.
Sphenorhina, new species of, 482.
 Stephenson, J., on a new species of the genus *Perionyx*, 540.
 Storrow, B., see Meek, A.
Styringomyia, new species of, 572.
Swammerdamella, new species of, 571.
 Tams, W. H. T., on new species of *Nygmia* from East Africa, 502.
Tasiocera, new species of, 290.
Telnobasis, new species of, 613.
Teleonemia, new species of, 436.
Tetraceratothrips, characters of the new genus, 628.
Tetranychus, new species of, 523.
Tenchothrips, new species of, 630.
Thaumatorhynchus, characters of the new genus, 624.
 Thomas, O., on the geographical races of *Oryzomys ratticeps*, 143; on new *Callicebus*, *Conopatus*, and *Eoomys*, 286; on a new subspecies of *Nyctinomus australis*, 455; on a new pouched mouse, 528.
Thyrosticta, new species of, 306.
Thysanoptera, new, 156, 625.
Tipulidæ, new, 289, 457.
Tomasia, new species of, 479.
Trovesa, characters of the new genus, 145.
 Triassic fauna from the Jordan Valley, 52.
Trichocladius, new species of, 172.
Typophorus, new species of, 247.
 Uvarov, B. P., on a revision of the Old World *Cyrtacanthacini*, 96; on a new genus of *Pamphaginae*, 617.
 Vinogradov, B. S., on two new interesting lemmings from Siberia, 186.
 Waters, A. W., on the ancestry of *Membranipora pilosa* and of other *Cheilostomatous Bryozoa*, 591.
 Watson, H., on the application of the law of priority, 328.
 Wells, H., on new species of *Cucumaria*, 113.
 Withers, T. H., on some *Oligocene* Decapod Crustaceans, 121; on *Decapod Crustaceans* from the *Oligocene* of A. Villa, 225; on the phylogeny of the Cirripedia, 313.
Zelandomyia, new species of, 301.
Zonitis, new form of, 131.

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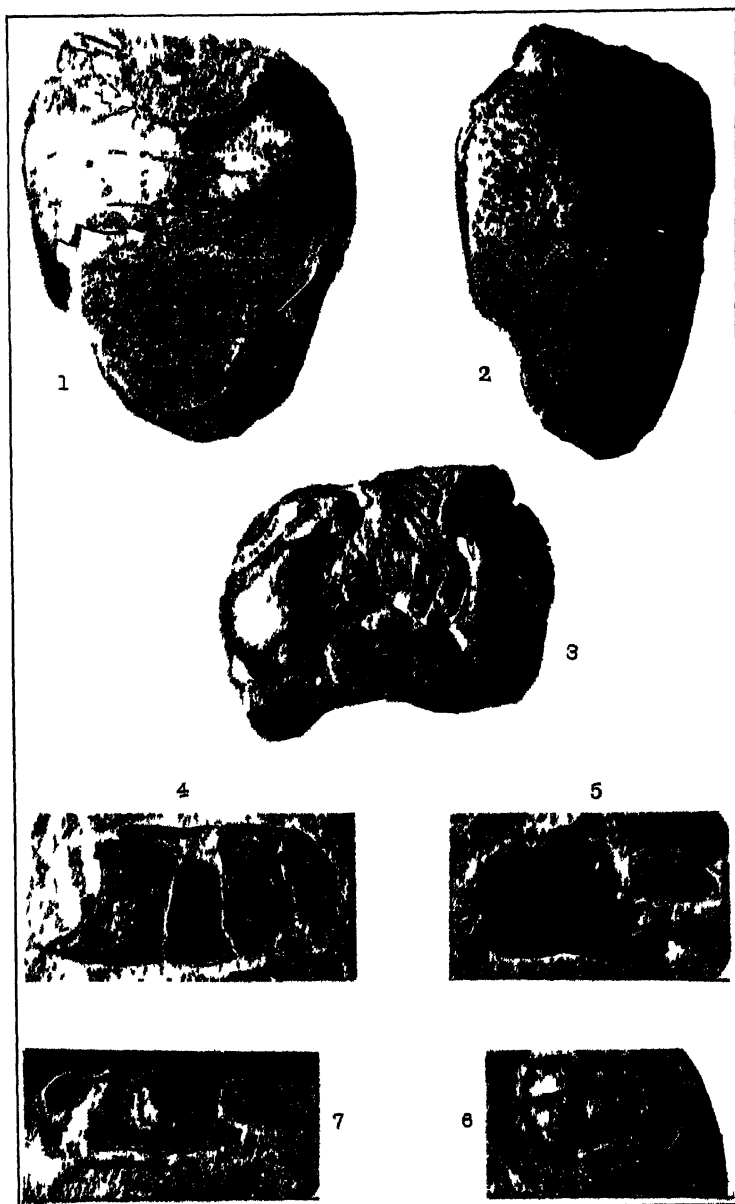


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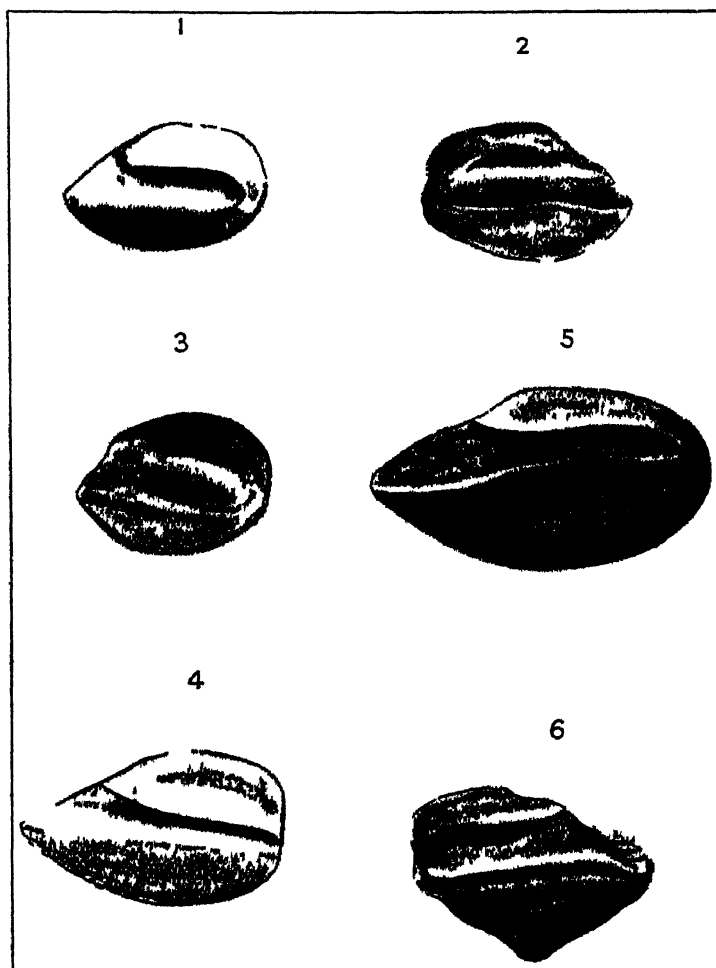


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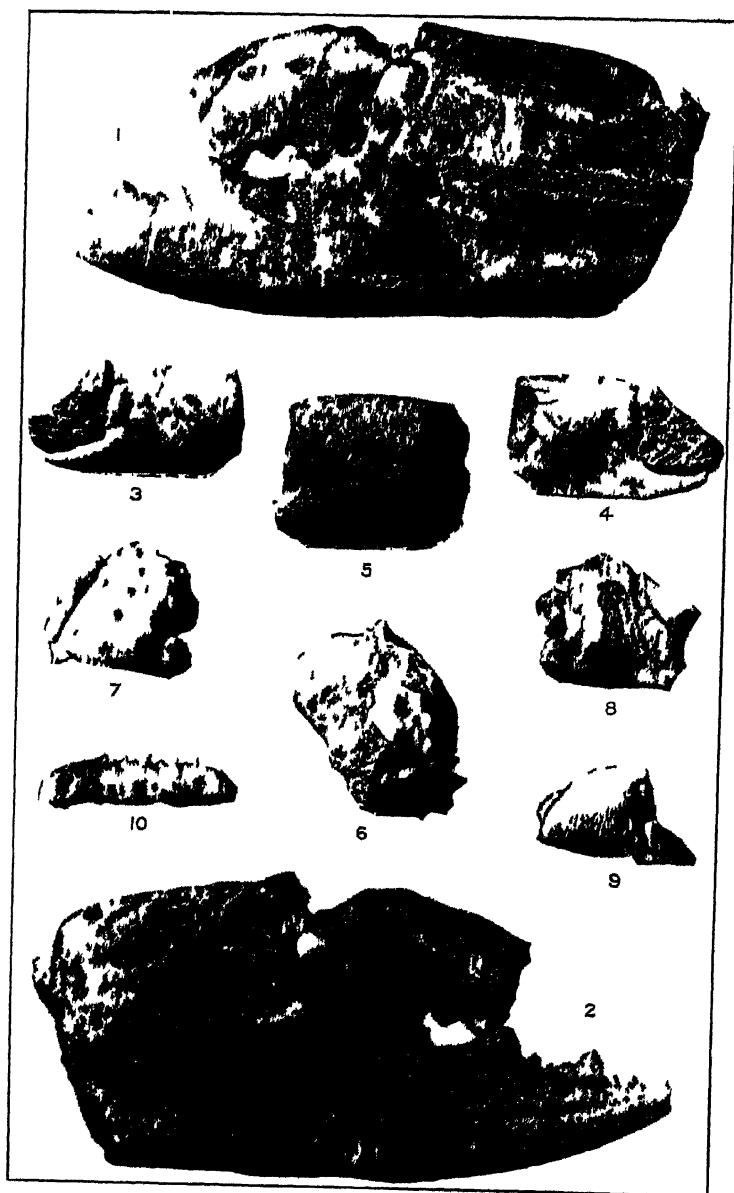


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Jurassic Otoliths



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Anguilla Tertiary Decapods

Fig 1



Fig. 2

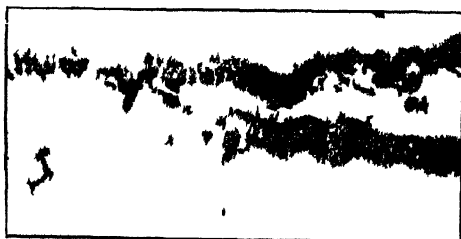
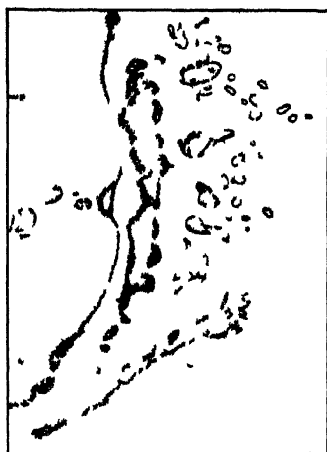


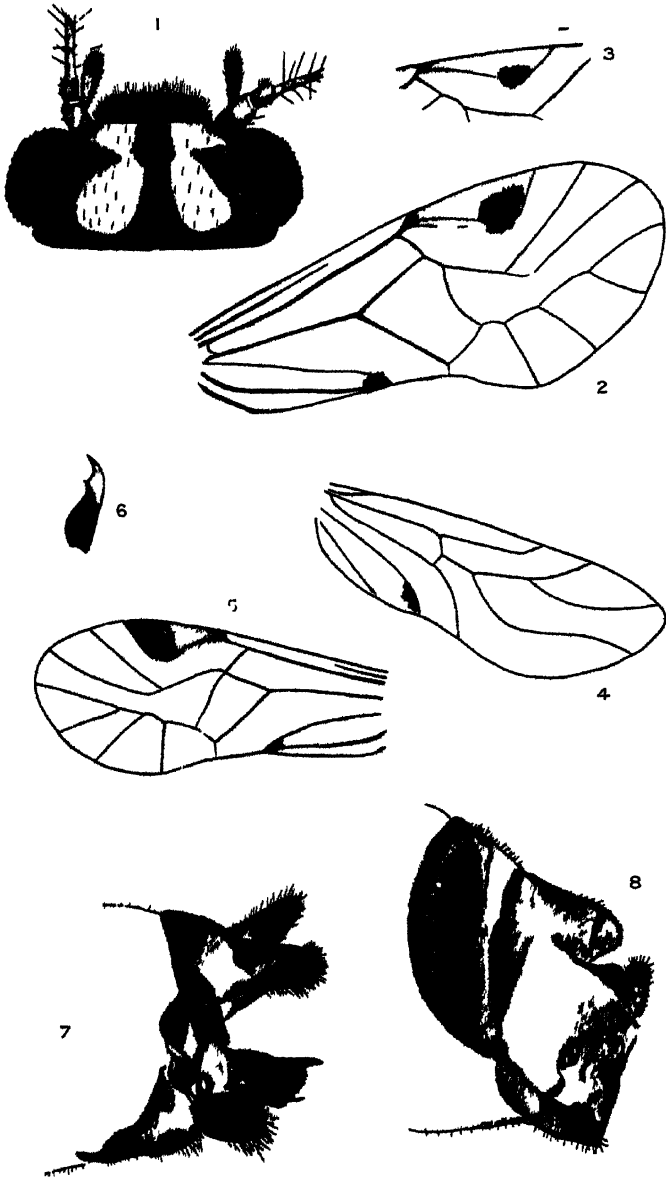
Fig. 3



Gills

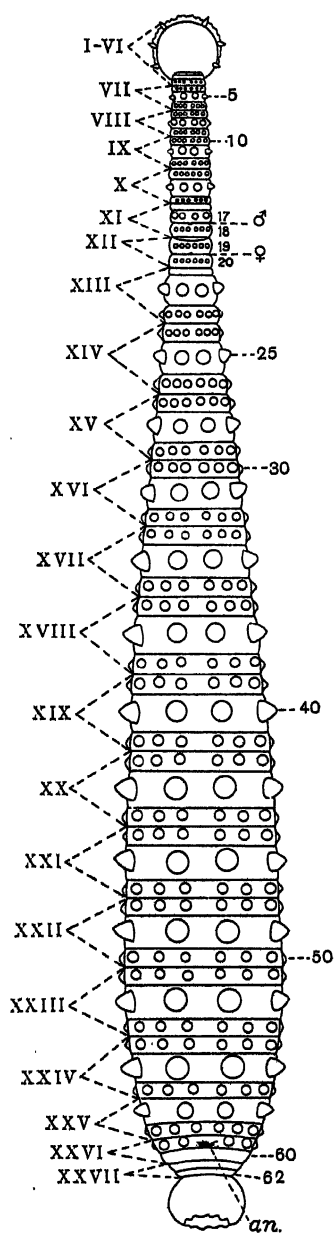
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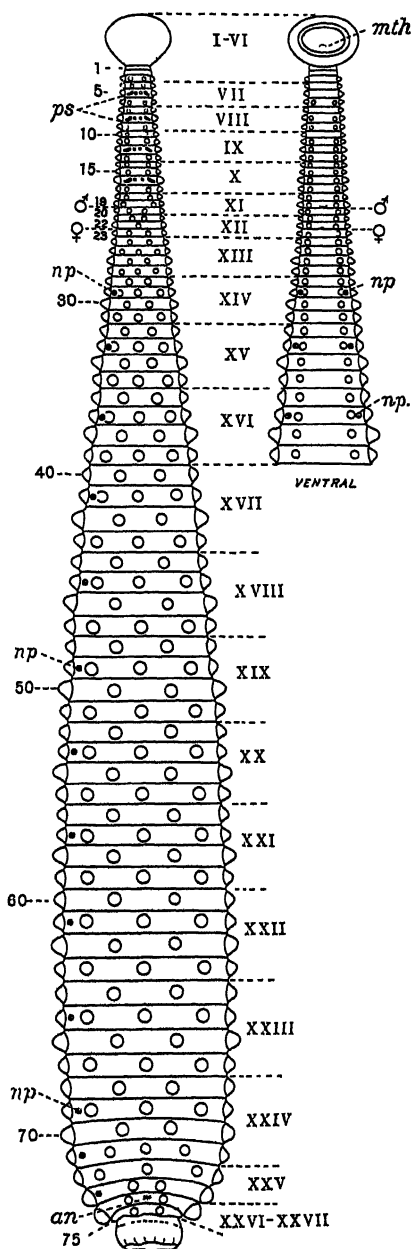


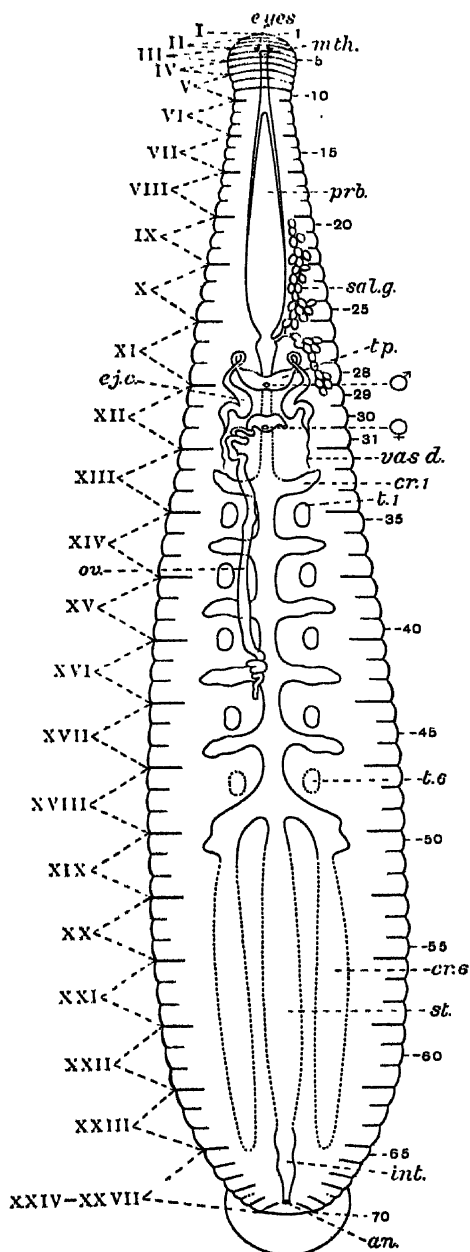
Satoru Kuwayama del

PSOCUS SAGHALIENSIS, sp. n

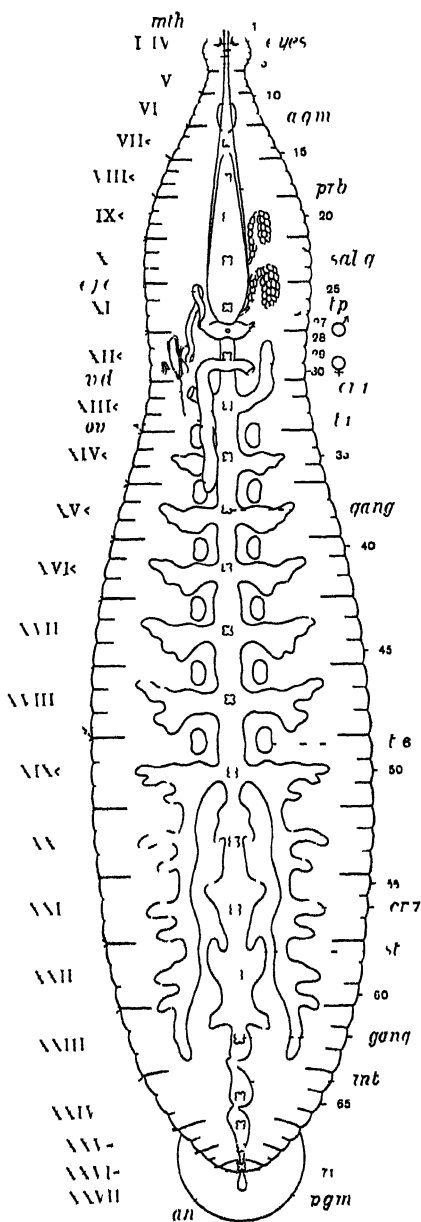


Pontobdella loricata, sp. n.

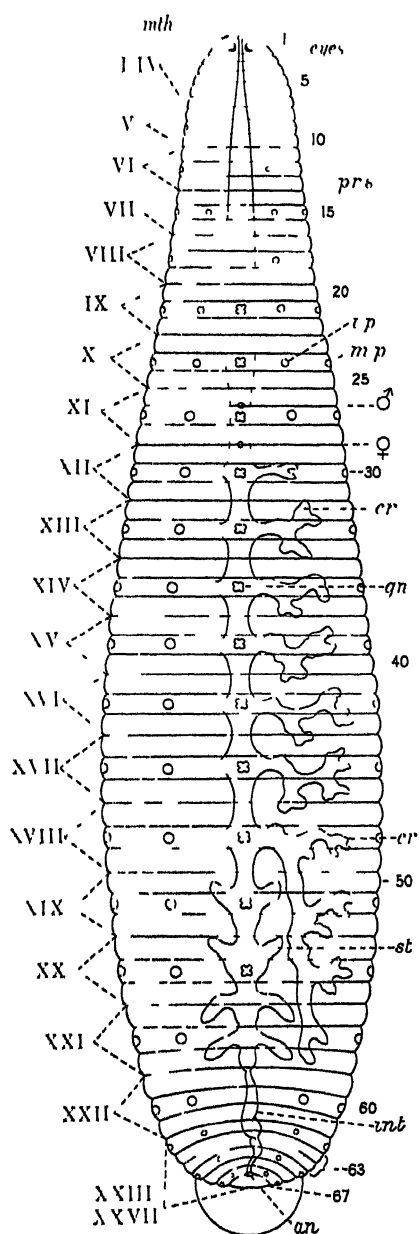
*Pontobdella aculeata*, sp. n.



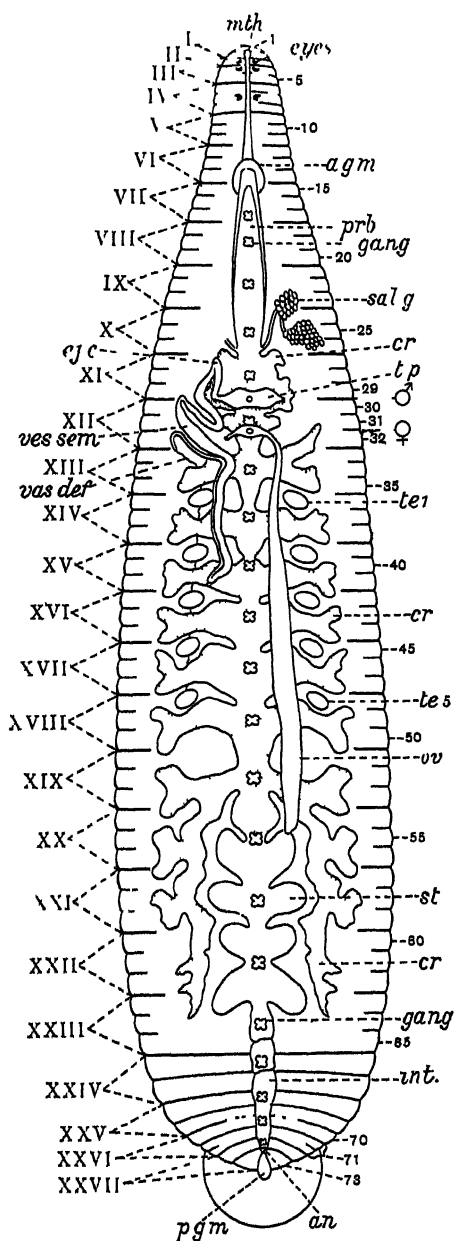
***Helobdella nociva*, sp. n.**



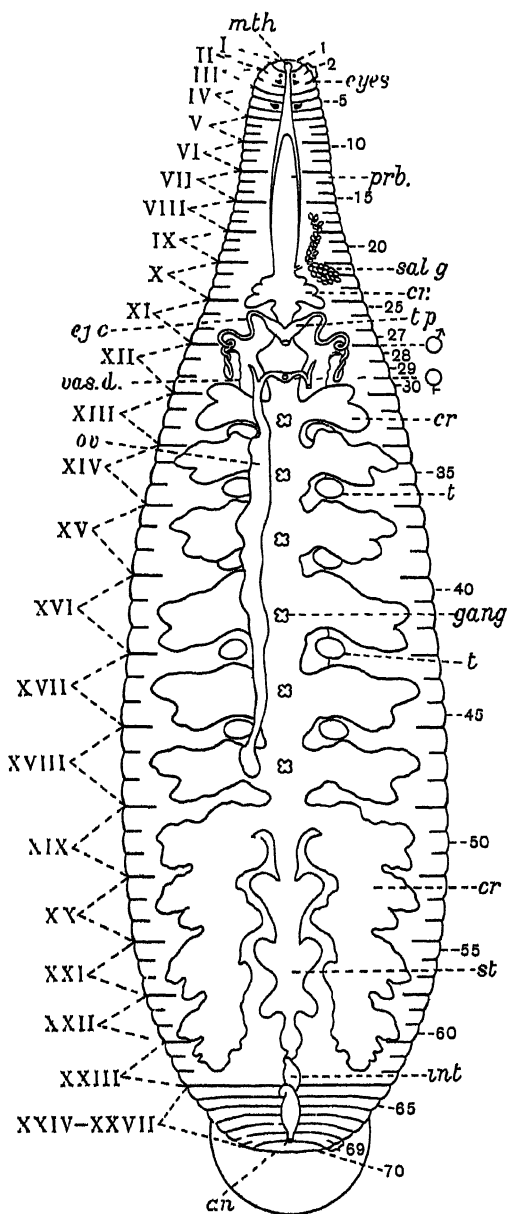
Placobdella undulata, sp. n.

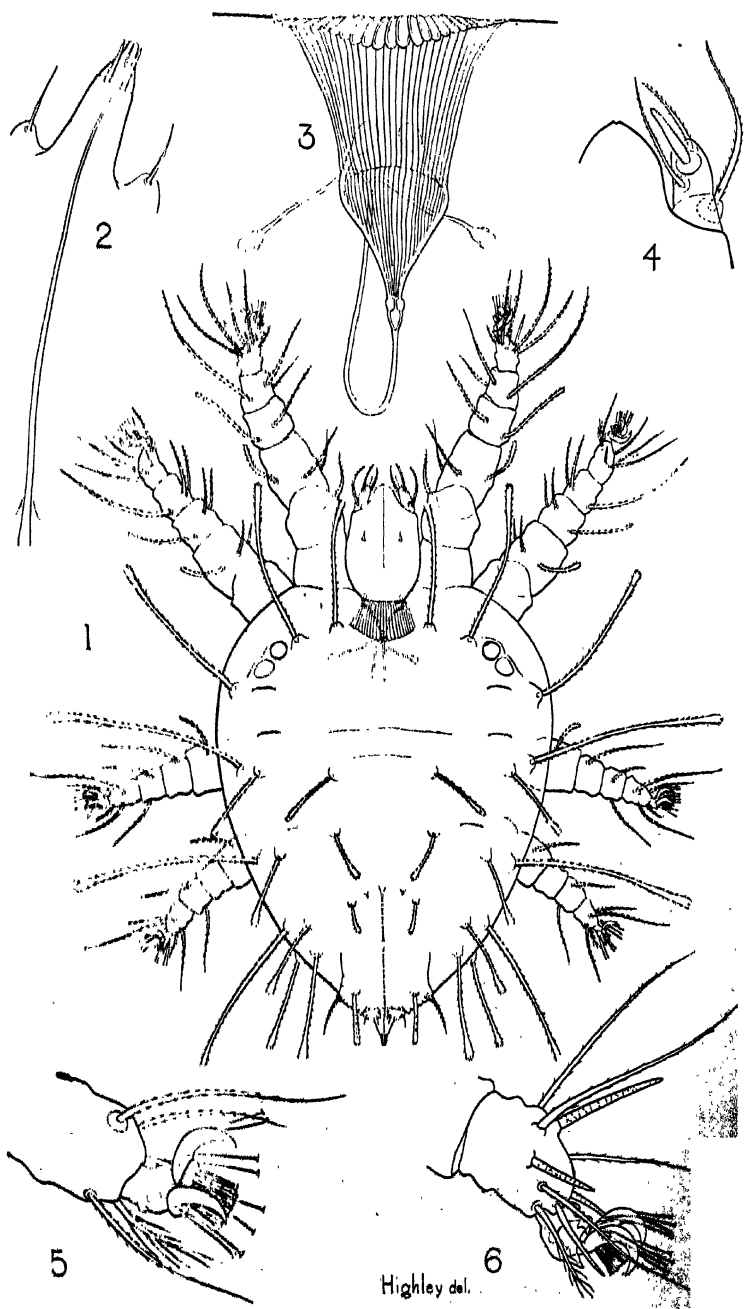


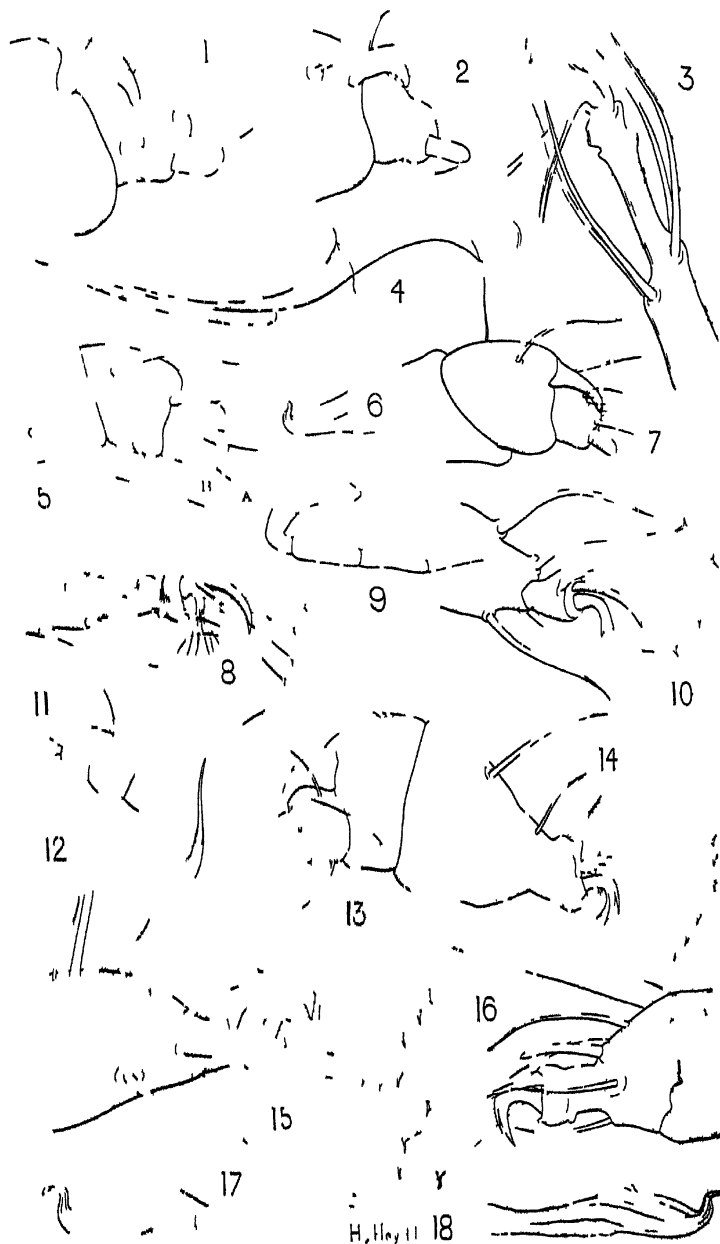
Placobdella fulva, sp. n.



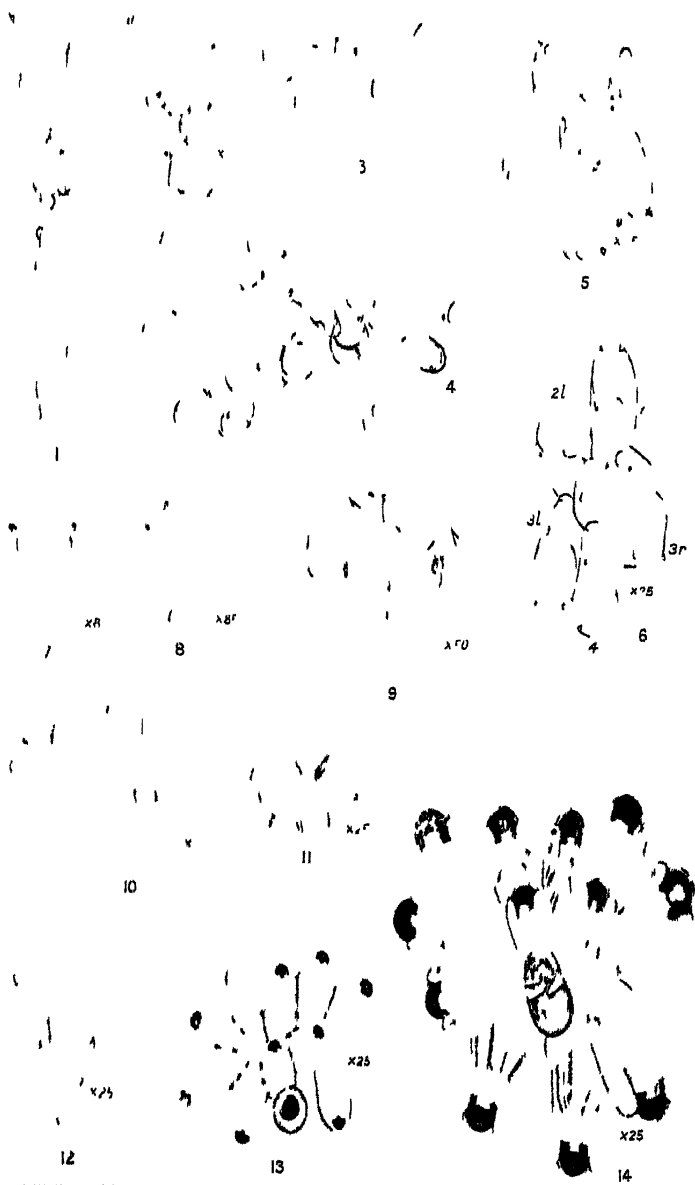
Paraclepsis prædatrix, sp. n.

*Paraclepsis vulnifera*, sp. n.





1, 4 Tetranychus hyiensis sp. n. 5, 10 Paratetranychus iselemae sp. n.
 11, 12 Paratetranychus ununguis 13-18 Tetranychus (Schizotetranychus)



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